The Electrical Industry's Weekly Magazine

January 7, 1957

Electrical World

Price 35 Cents

A McGraw-Hill Publication

The New Electrical World

. . . see page 5

E B POWER GS W 12
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

THE PROTECTION LASTS

● *WHEN you use* ***Texaco Regal Oil R&O,*** *you always have an extra margin of safety because of the lasting protection it gives.*

Throughout the years of its extra long service life, *Texaco Regal Oil R&O* keeps turbine systems free from sludge, rust and foam; assures normal bearing temperatures and instantaneous governor response.

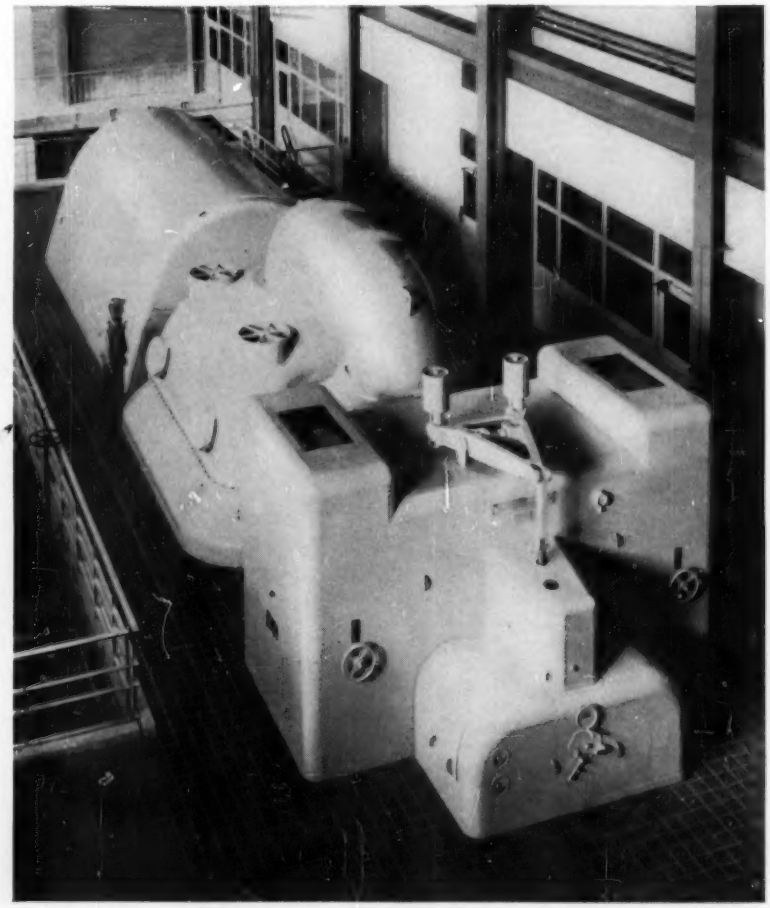
Texaco Regal Oil R&O is premium quality—with great natural lubricating properties further improved by special additives. It has outstanding resistance to oxidation. It protects bearings against corrosion. It keeps systems clean.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all leading turbine builders for all types and sizes of turbines.

Let a Texaco Lubrication Engineer help you get maximum efficiency from your turbines and power auxiliaries. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Electrical World

Vol. 147, No. 1 Jan. 7, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

Outlook on Fuel: Prices Will Climb
Supplies of coal, oil, and gas are adequate, but higher labor and construction costs are forcing up prices.....p 40

3-Year Report Shows Progress in N. Y. Wiring Program
Consolidated Edison's AW program is bringing higher capacities and heavier wiring to existing buildings and new construction .....p 44

MANAGEMENT

R/W, Site Study Spots Problems
Utilities fight to beat scarcity of sites and rising costs.....p 47

Power Teaching Can Be Revitalized
A college engineering dean tells the utilities how to get all the engineers they want.....p 54

TRANSMISSION

Single Poles Carry 138-Kv Line
If there is no room for H-frames, here is a possible solution .....p 57

RELAYING

System Relaying Modernized
Toledo Edison program improves system operation.....p 58

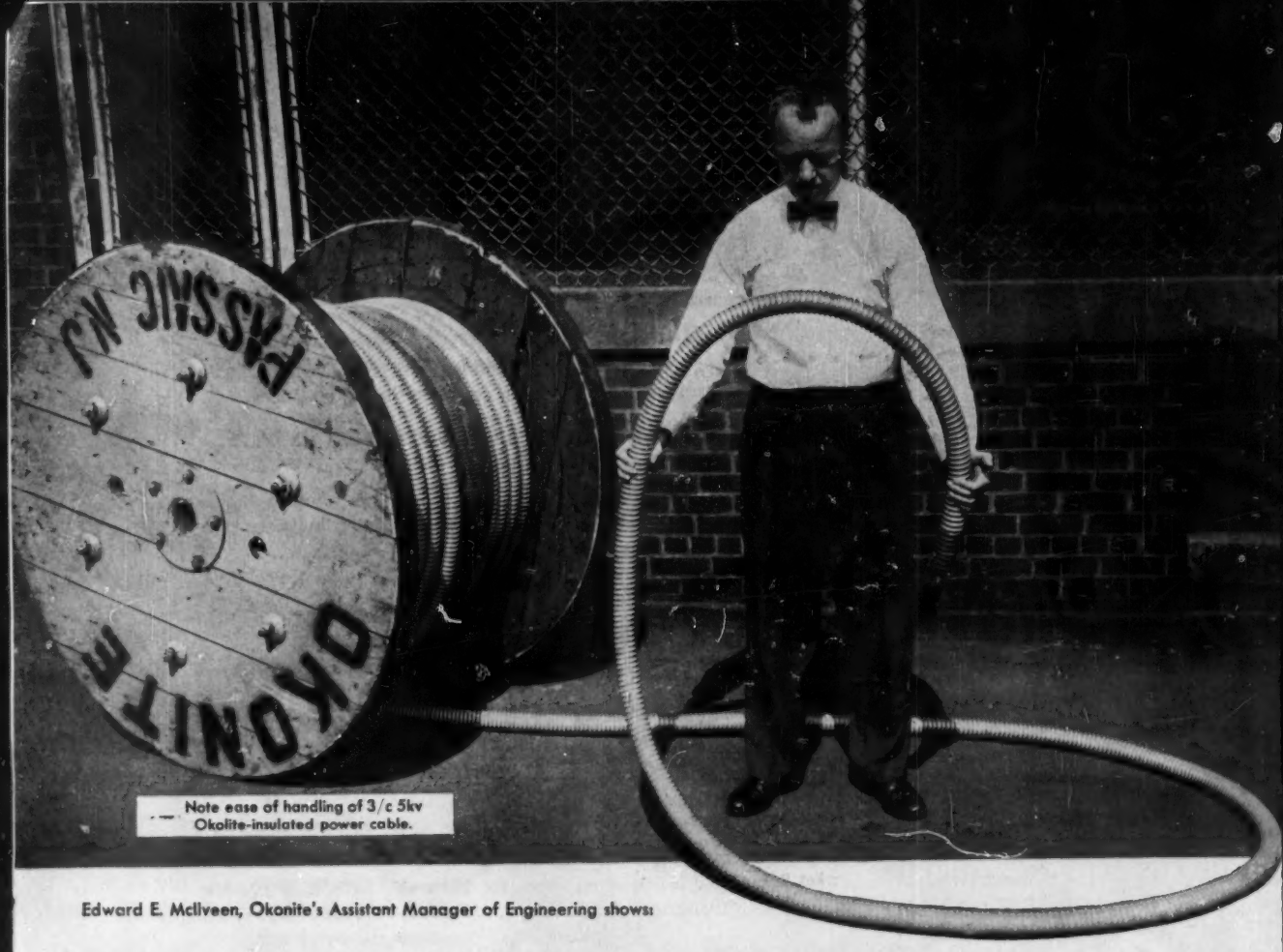
GENERATION

First Plant Designed to Burn Fluid Coke
Delaware P&L reveals details of plant built to burn new fuel .....p 60

Departments

Atomic Progress	43	Meetings Calendar	116
Catalogs and Bulletins	92	New Equipment	86
Editorials	39	News About People	112
• Electrical Newsletter	19	News-Beat	46
From the Publisher	5	Readers Forum	118
How To	63	Selling	74
• Management Newsletter	107	Technical Literature	94
Manufacturers and Markets	99	Washington Wire	42

INDEX TO ADVERTISERS.....125



Note ease of handling of 3/c 5kv Okolite-insulated power cable.

Edward E. McIlveen, Okonite's Assistant Manager of Engineering shows:

Why Loxarmor is the low cost alternative to conduit

Rubber-insulated Loxarmor Interlocking S-shaped armor cables provide an ideal combination of flexibility, light weight and mechanical strength. Where rigid conduit is not desired, Loxarmor is the No. 1 alternative for either power or control circuits. Here's why:

Material and installation costs are lower. Eliminates conduit and related installation procedures such as making bends and using pull boxes. It is especially useful in cramped quarters.

Circuits are easily added or re-routed—usually trained in trays or racks, Loxarmor cables can be easily moved.

Easy accessibility reduces down-time—permits quick inspection. Can be installed indoors and outdoors.

Loxarmor occupies less space—not much more than half the space is required for multiple Loxarmor circuits vs. circuits in conduit.

Loxarmor can be supplied with the strip-insulated insulations Okolite oil-base or Okonex butyl-base; with extruded Keystone or Watertite insulations; or with varnished cambric—all depending upon your installation conditions and voltage requirements.

Loxarmor is available in galvanized or stainless steel, aluminum, bronze or copper armor. May be obtained with either copper or aluminum conductors. For further information write for Bulletin EW-1090. The Okonite Company, Passaic, N. J.

4161-A

where there's electrical power . . . there's **OKONITE CABLE**

Electrical World Staff

Fischer Black Publisher and Editor

Daniel T Braymer Assistant to the Editor

Engineering

Leonard M Olmsted Managing Technical Editor
John J Kearney Assistant Managing Technical Editor
Howard S Knowlton New England Editor
Edward Allen Midwestern Editor
Francis J Kovalcik Western Editor
David Rea Southeastern Editor
James G Plunkett Northeastern Editor
Charles F Hochgesang Associate Editor
Archer E Knowlton Consulting Editor

News

Herbert R Frankel Managing News Editor
Jesse A Mock Assistant Managing News Editor
Rue M Shoop Associate Editor
Allen Long News Editor
Theodore W Fuller and Denise Hennessy Editorial Assistants
Thomas R Jordan Commercial Editor
Kenneth N McLean Industrial Editor
George B Bryant, Jr Manager, Washington Bureau
V Craig Richter Washington Correspondent
Domestic News Service: Atlanta, Chicago, Cleveland, Dallas, Detroit, Houston, San Francisco.
World News Bureau: John Wilhelm, Editor; Bombay, Bonn, London, Mexico City, Paris, Rio de Janeiro, Tokyo.

Special Services

Arthur J Stegeman Manager, Market Research
Dexter M Keezer Director, Economics Department
Theodore C Boyden Economist

Production

Kenneth K Kost Manager of Production
George Swift Assistant Manager of Production
Frank C Stockman Art Director
H Tomlinson Howland, Jr Production Editor
Elaine Maguire Assistant Production Editor

Advertising

Warren W Shew Sales Manager
District Managers: N V Palmer and E S Chapin, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; E E Schirmer, Los Angeles; R C Alcorn and T H Carmody, San Francisco; William Lanier, Atlanta; Douglas Billian, Dallas.
Otto Drechsel Business Manager
Donald K Ellis Promotion Manager

•

E Bryson Sessions Circulation Manager

. . . from the publisher

This is the new Electrical World—The Electrical Industry's Weekly Magazine. As always it's filled with outstanding news and technical information. But now it has many added and exclusive features patterned after your suggestions to us in personal interviews. Furthermore, this is the book you will get every week.

Here are some of the new features:

1. A Contents Page to guide you through the book.

2. This publisher's column to give you "the inside" on EW's operations and editorial material.

3. The "Electrical Newsletter," a front of the book feature on ivory paper, consisting of:

"News-Scope," page 19, to bring you the latest news of our industry.

"Electrical Week," page 20, to provide you with a two-minute, two-page summary of the entire book.

"Engineering Trends," page 22, to keep you alert to technical progress within and without the industry.

4. "Washington Wire," page 43, to summarize for you the news in the nation's capital of significance to the industry.

5. "Atomic Progress," page 44, to keep you abreast of the latest developments in the nuclear field.

6. "Management Newsletter," a back of the book feature on ivory paper, consisting of:

"Electrical Business Outlook," page 107, to help management and manufacturers plan for tomorrow.

"Statistics," page 108, to report to you in figures the industry's progress. This is the new location of the chart on weekly energy output.

Newsletter-type reports, page 109, to cover the significant happenings in the fields of finance, regulation, and public and industrial relations. "Your Health," written by a medical doctor, will appear in these pages.

Best of all, we are going to use larger type, the size you approved after a test run last Sept. 24.

Fischer Black

ABP ELECTRICAL WORLD ABC

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial and Advertising Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y.

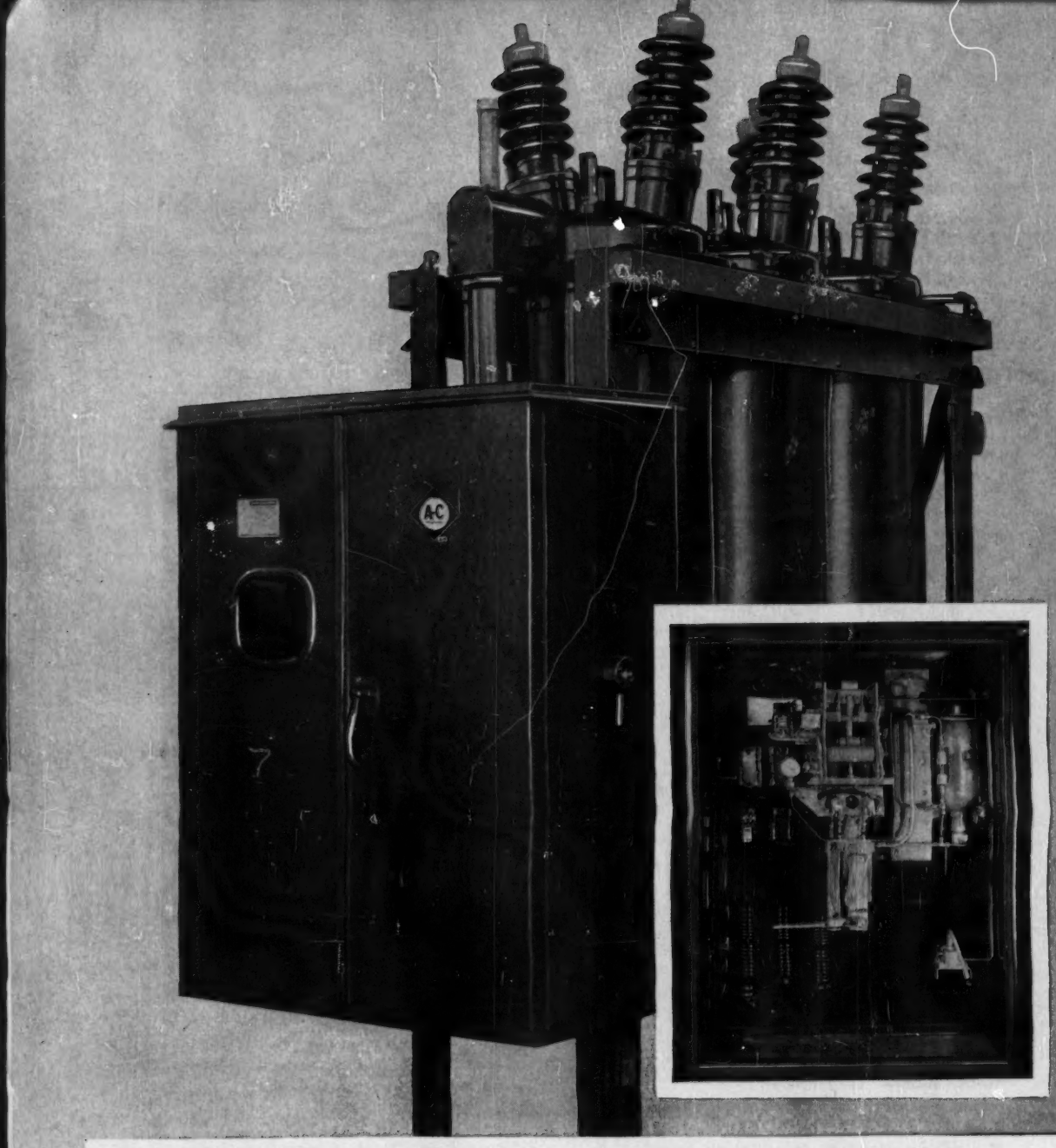
Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are solicited only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and possessions and Canada, $6 a year, $9 for two years, $12 for three years. Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries, $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter at the Post Office at Albany, N. Y. Printed in USA.

Copyright 1957 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.



Now Pneu-Draulic Operators

At the request of numerous utilities, Allis-Chalmers design engineers have now made available to you *Pneu-Draulic* operators on smaller breakers.

Enjoy the simplicity and reliability of the *Pneu-Draulic* operator on your next breaker.

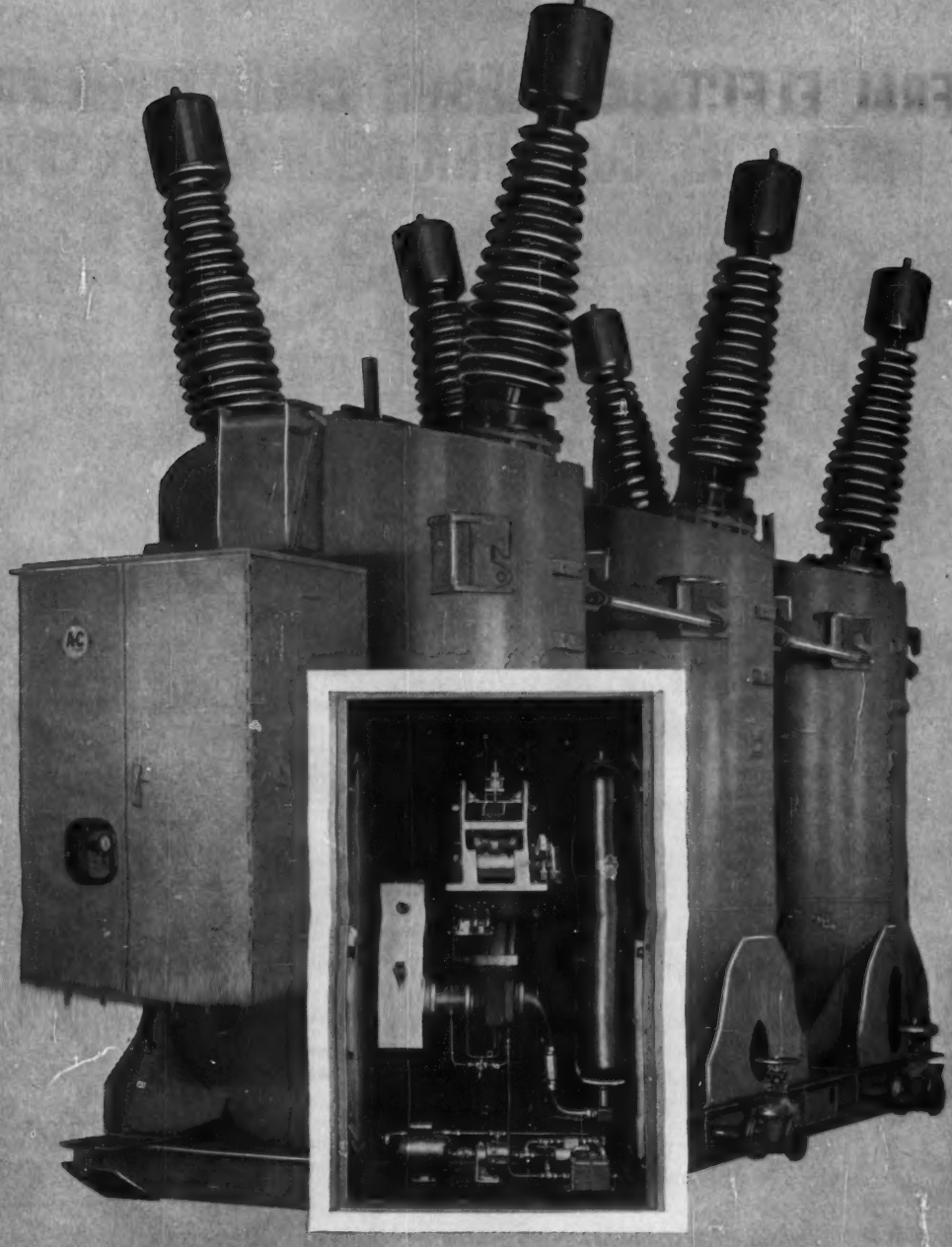
Acceptance of the *Pneu-Draulic* operator is based on the fact that it's as simple as it looks. It eliminates the mechanical problems inherent in previous mechanisms.

For complete information call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Pneu-Draulic is an Allis-Chalmers trademark.

LIVE BETTER ELECTRICALLY

ALLIS-



for Breakers 500 Mva and Larger

Features of *Pneu-Draulic* Operator

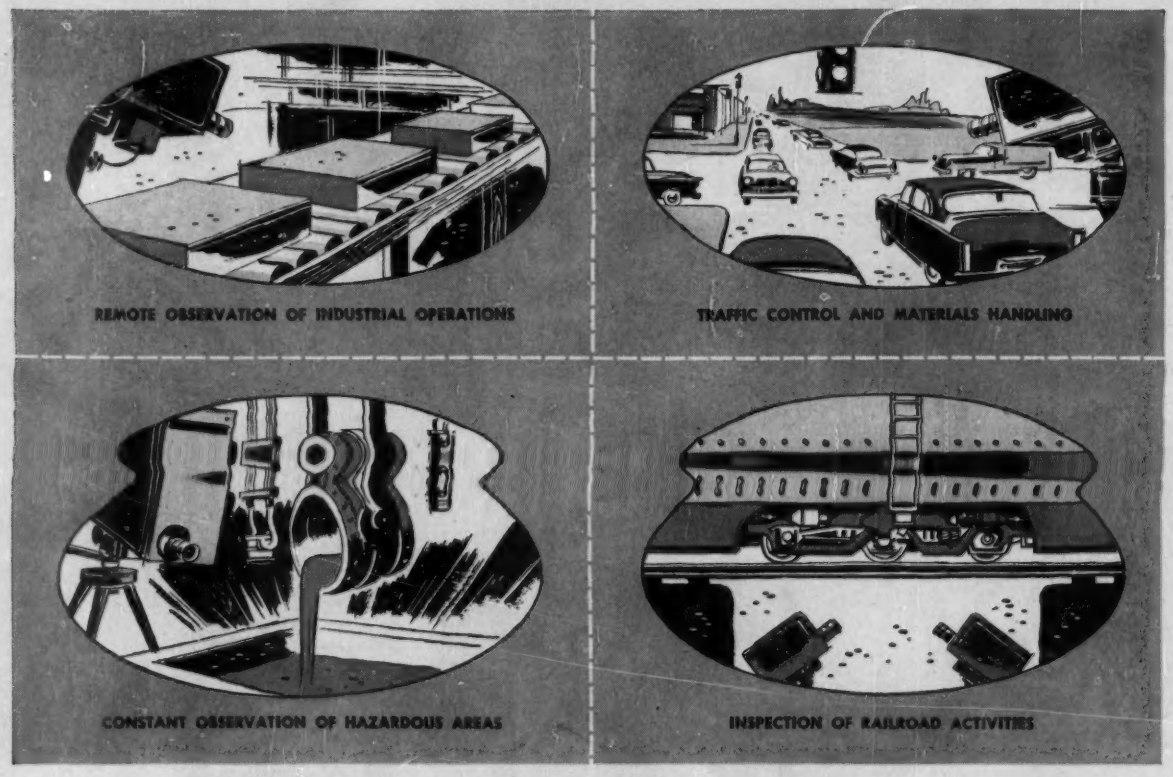
- Simple — Has fewer parts than other types of operating mechanisms.
- Eliminates moisture, corrosion, dust problems — entire system filled with oil containing inhibitor. Filtering eliminates dirt problem.
- Provides emergency closing — can be closed safely onto energized line when no control power is available.
- Mechanically trip-free.

CHALMERS

A-C ALLIS-CHALMERS

A-5131

GENERAL ELECTRIC CLOSED CIRCUIT TV PROVIDES RELIABLE VISUAL COMMUNICATION AT LOW COST



REMOTE OBSERVATION OF INDUSTRIAL OPERATIONS

TRAFFIC CONTROL AND MATERIALS HANDLING

CONSTANT OBSERVATION OF HAZARDOUS AREAS

INSPECTION OF RAILROAD ACTIVITIES

With Compact INTRA-TEL TV on the job, you can sit at your desk and see immediately *and at will:*

- Proceedings in any manufacturing department
- Close-ups of indicators, gauges, or dangerous operations
- Smoke conditions at the top of the stacks
- Outgoing or incoming shipments at loading docks
- Persons being interviewed for credit, employment, security, etc.
- Documents and signatures

in fact, almost—ANYTHING... ANYWHERE... ANYTIME!

THREE self-contained units, with plug-in connecting cable, bring you a complete visual communications system that is effective, efficient, and practically foolproof. Each unit is portable, and ruggedly built to withstand years of heavy industrial use—under many conditions of heat, humidity, vibration, dust, fumes, etc.

The light-weight, compact units of the INTRA-TEL system are easily moved to cover changing needs and situations. Additional monitors or standard TV receivers can be used to provide multiple viewing locations, either locally or remotely. A multiple camera system, with accessory switching equipment, is also available.

WRITE TODAY FOR FREE BOOKLET!

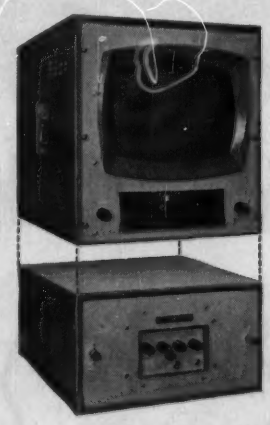
This new, illustrated booklet explains the entire INTRA-TEL System...lists many industrial applications. Your copy is waiting—write today, on your letterhead please, mentioning ECL-53 for black and white, or ECL-39A for color system. *General Electric Company, Industrial Electronics Division, Broadcast Equipment, Section A2217, Electronics Park, Syracuse, New York.*

The basic system is housed in three small, compact units...easy to place, easy to move!

The CAMERA
Type TG-2-A. Takes the picture of subject, scene, or action.

The MONITOR
Type TH-6-A. Shows the picture as taken by the camera. Conventional home-style TV receivers may be used as additional receivers or monitors.

The CONTROL UNIT
Type TH-5-A. Controls and transmits the picture from camera to monitor.

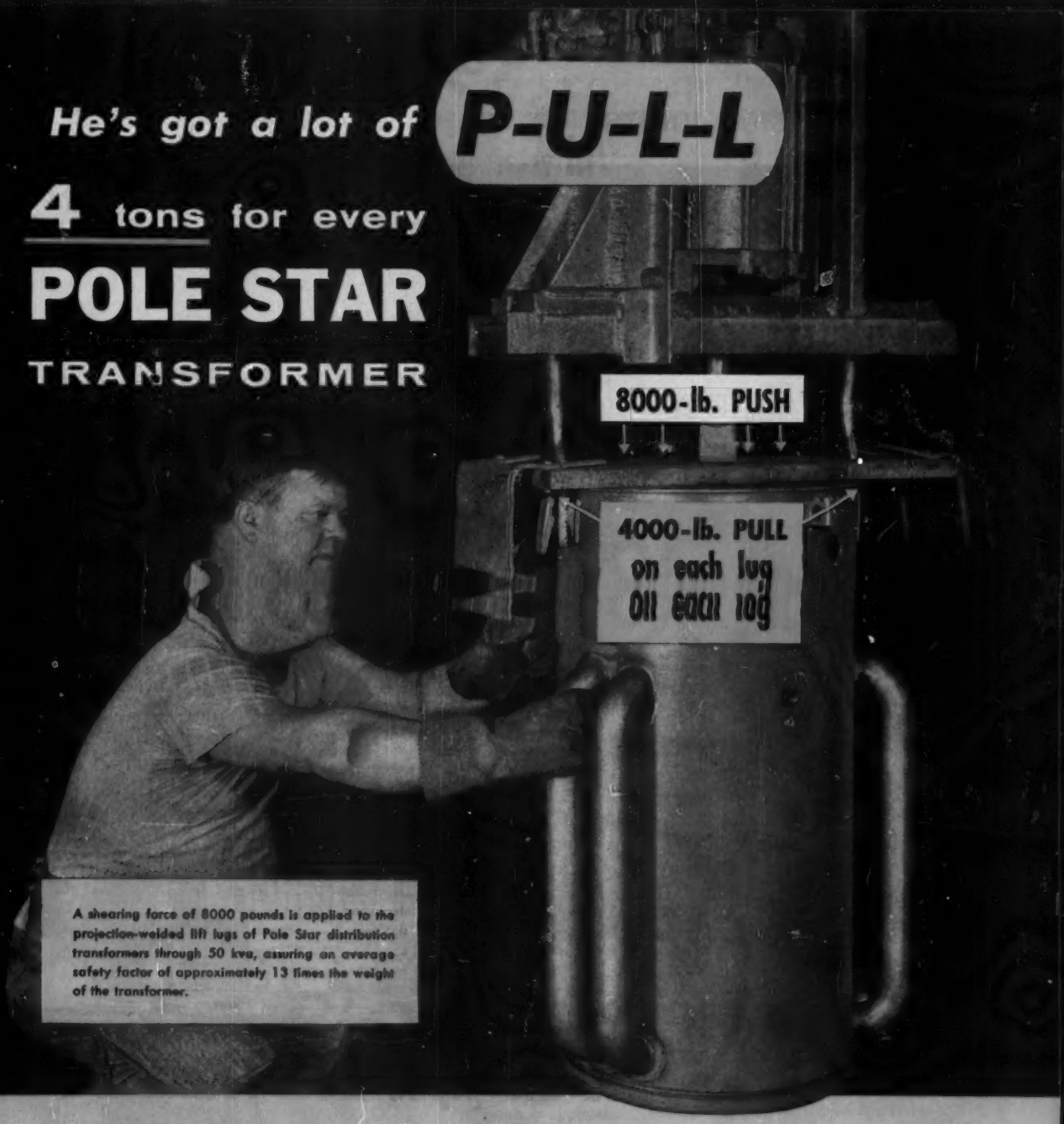


Progress Is Our Most Important Product

GENERAL ELECTRIC

He's got a lot of P-U-L-L

4 tons for every POLE STAR TRANSFORMER



A shearing force of 8000 pounds is applied to the projection-welded lift lugs of Pole Star distribution transformers through 50 kva, assuring an average safety factor of approximately 13 times the weight of the transformer.

Lift lugs of Pole Star distribution transformers through 50 kva* are subjected to a shearing test that simulates a 4000-lb. "lift" for each lug. Depending on the weight of the transformer, this Pole Star production control assures an average safety factor of approximately 13.

The shearing force is produced by a hydraulically powered lift that pulls upward on the lugs (total pressure is 8000 lbs.) while the transformer tank is held firmly in place by means of the center rod and transverse bar visible above. This force is great enough to shear off any lugs that are not perfectly welded, so that no "borderline" cases can survive the test.

Even years after a transformer is installed, the reliability of lift lugs can be of extreme importance. (For example, the unit might be removed for replacement by a larger transformer, or for repainting.) To make certain that Pole Star quality will be maintained during the years ahead, every lift lug is coated with a long-lasting sealing compound before being projection welded. This compound prevents rust-weakening of the lift lugs by effectively blocking out moisture from the welded area.

**Different manufacturing and testing procedures are used for the lift lugs of larger transformers.*

167 Production Controls make Pole Star Best!

POLE STAR

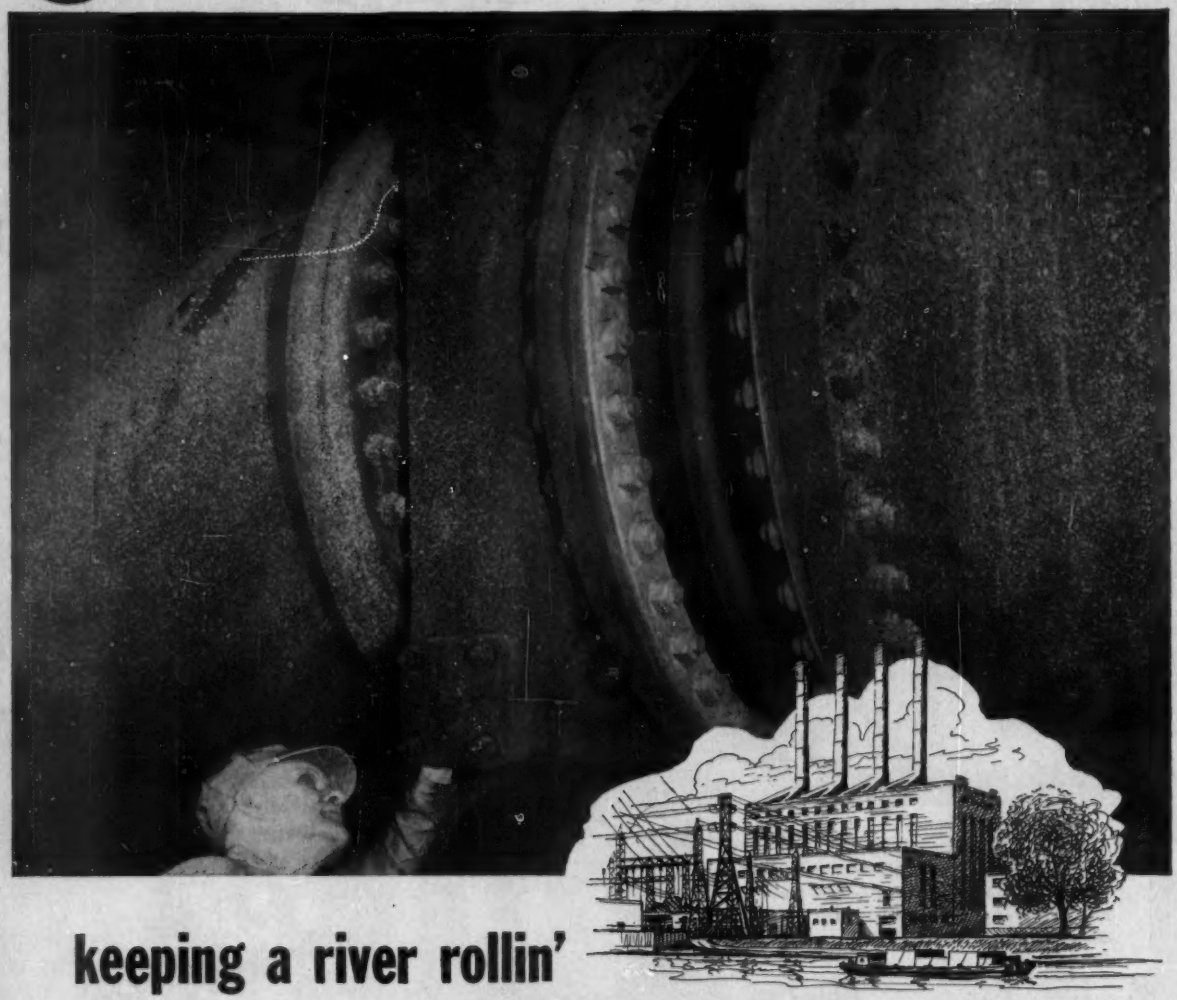
3 through 500 kva, through 67,000 volts

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

US RUBBER

EXPANSION JOINTS



keeping a river rollin' and the pipes from rockin'

A river of 390,000 gallons of water per minute rolls through the four surface condensers in Niagara Mohawk Power's plant at Oswego, New York. Here is generated enough power to heat 384,000 household steam irons every hour. Ravenous furnaces consume 3600 tons of coal every 24 hours at full load.

The piping in Niagara's condenser system can't rock or rattle itself to death despite the tremendous capacities and pressures encountered. U. S. Rubber Expansion Joints are the flexible connections that allow the pipes to give and take, to literally ride with the punch.

"These Expansion Joints were installed in 1940," says the plant superintendent, "and they've never given us trouble. We use them in sizes from as small as 6" all the way up to 48", and at water temperatures up to 170 degrees Fahrenheit. We know we will get many more years' wear out of them."

To absorb excess stresses due to expansion and contraction, to insulate against vibration, take care of misalignment, specify U. S. Expansion Joints. They are available at any of the 28 "U.S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

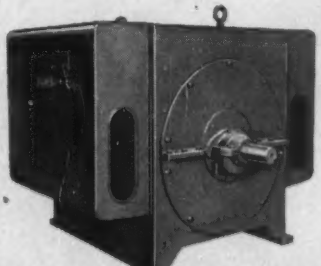
United States Rubber

LOOK BEHIND THE "INSULATION CURTAIN" BEFORE YOU SELECT A LARGE MOTOR

Skilled hands weave an impenetrable wall around every Elliott coil

● The slot section of this Elliott Class A stator coil is being hand-wrapped with a Mylar*-backed pliable, laminated mica sheet. The Mylar provides a thin, tough, flexible backing which allows a 30% increase in the amount of mica used. Mica combines known high dielectric strength with proven ability to withstand temperature and age. Through it all, the skilled hands of the Elliott craftsman guide it carefully and surely.

In coil insulation, the most modern materials are no better than their application. That is why coil insulation is a long painstaking process at Elliott. Extra precautions are taken at coil leads, joints and end sections. Vacuum-pressure impregnation plus *complete immersion* of each wound stator insures full penetration and an all-over sealing by a specially selected, time-proven insulating varnish. It's all part of an insulation process for 600 volt through 4800 volt coils first developed by Elliott in 1948 to withstand moisture, dirt, chemical fumes, etc. In all these years this insulation system has never suffered an operating failure. Get the facts on this sure "field-proven" insulation system. Ask your Elliott field engineer or write Elliott Company, Ridgway Division, Ridgway, Pa.



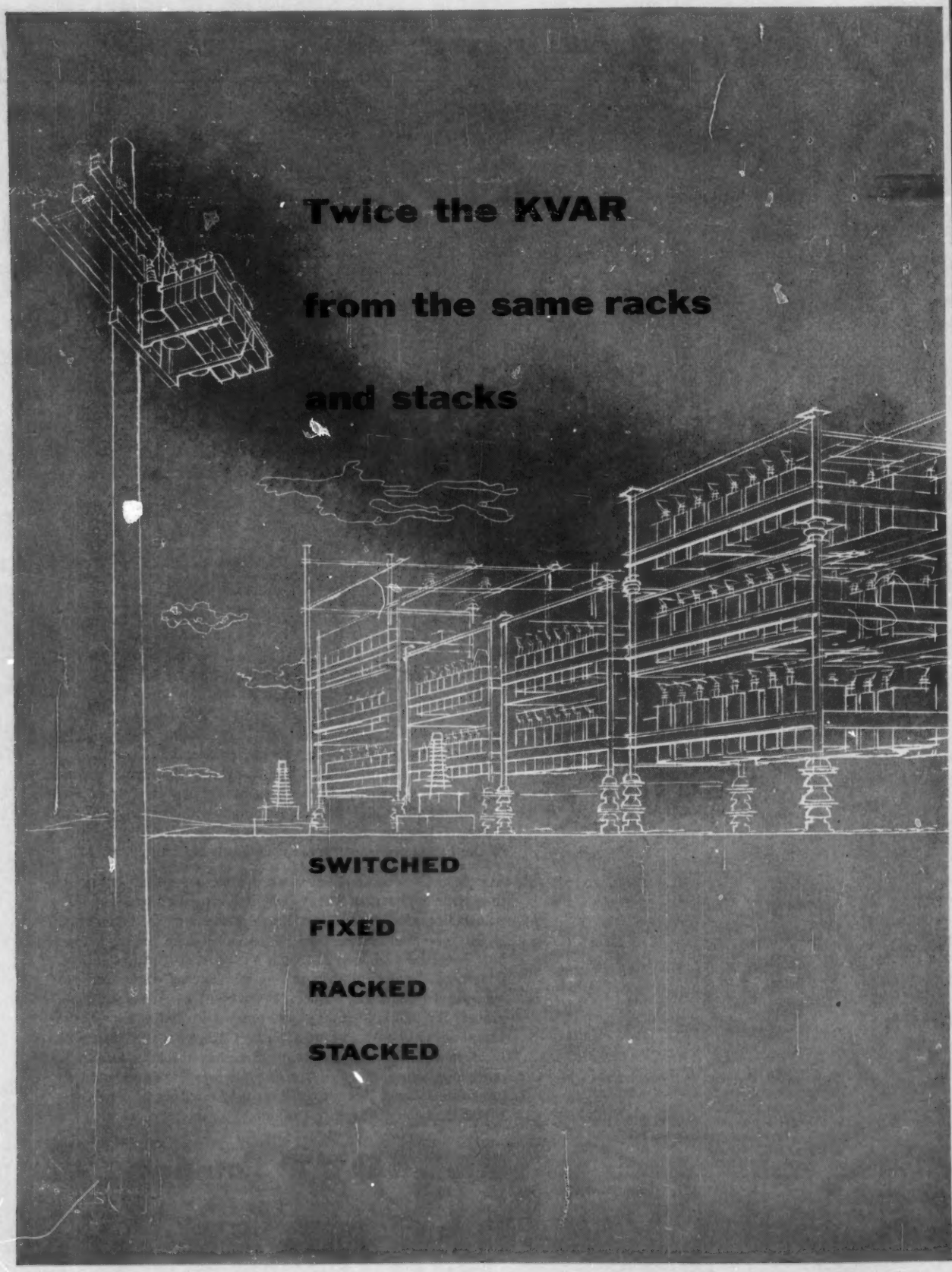
Elliott squirrel-cage induction motors lead the field in insulation. Since 1948, out of 1,400,000 hp of motors with this insulation system, (installed in 42 states and 14 foreign countries) not one stator coil has failed due to insulation breakdown or deterioration.

ELLIOTT Company

RG-9

*Dupont Trademark

Elliott large motor insulation is "field-proven"


Twice the KVAR
from the same racks
and stacks
SWITCHED
FIXED
RACKED
STACKED

NEW

WESTINGHOUSE

50-KVAR

CAPACITORS

With these 50-kvar units you can chalk up savings in three important areas—time, space, labor—all of which add up to important money. These new power capacitors for high-voltage outdoor applications have the same mounting dimensions as the 25-kvar units. Only the height has been increased. Thus, twice the kvar capacity in the same racks.

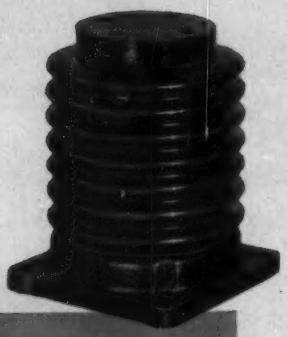
And in stacking, too, over-all rack space can be cut by 50% . . . factory assembled, in racks and stacks—fixed or switched—ready to put on the line. Even the lower price per kvar of 50-kvar units is secondary to the real economy of service, installation, space-to-capacity ratio and performance.

Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60899

YOU CAN BE SURE...IF IT'S

Westinghouse

No question of responsibility with



Lapp INDOOR SWITCH AND BUS SUPPORTS

Lapp BACK-CONNECTED BUSHINGS

RATING, Kv		2.5	5	7.5	15L	15H	23	34.5
1.5 x 40 withstand, Kv		45	60	75	95	110	150	200
60 ~ withstand, Kv		15	19	26	36	50	60	80
CLASS A	A-10	X	X	X				
	A-20		X	X	X	X		
	A-30		X	X	X	X	X	
CLASS B	B-20		X	X	X	X		
	B-30			X	X	X	X	X
	B-40			X	X	X	X	X
	B-50			X	X	X	X	X
CLASS D	D-20			X	X	X		
	D-30			X	X	X	X	X
	D-40			X	X	X	X	X
	D-50			X	X	X	X	X

Throughout the range of NEMA standards (SG6-6.06) . . . in three design types, in five strength groups, and in voltage ratings 2500 to 34,500 . . . Lapp Indoor Bus Supports and Lapp Back-Connected Switch Bushings are *matching* series. They match in heights, diameters, strengths, and electrical characteristics.

But, in specifying Lapp bus supports and back-connected bushings, you gain more than the convenience and economy of interchangeability. Yours also is the assurance of single responsibility for performance of porcelain, metal parts and complete insulator assembly. And Lapp responsibility always means an extra margin of operating security, low upkeep and long life.

Available as standard or on specification from all leading switch manufacturers.

◀ Lapp Indoor Switch and Bus Supports and Lapp Back-connected Bushings are available as catalog items in matching voltage ratings, strength groups and design classes as indicated at left.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Proven Leadership*

*IN 1955 . . . MORE UTILITIES BOUGHT

POWERS American

SERVICE BODIES

THAN ANY OTHER MAKE

HERE'S WHY! Powers-American builds *fine* service bodies . . . and *builds them to last.*

Powers-American can furnish the *just right* body for any service job—standardized for greatest economy . . . modified-standard, to fit individual job needs . . . custom-made, to meet specific operating requirements.

Whether you have one truck or the largest fleet . . . you'll find it worthwhile to get details from Powers-American next time you need service bodies for your operation.

SERIES 350 Bodies have an under-floor winch, a fold-over derrick, and an extension ladder. Compartments are equipped to carry a variety of service tools, parts, and materials.

SERIES 25 Bodies are available in standard models equipped specifically for telephone, electric, gas, or water meter installation and service.

SERIES 44L Bodies have same construction features as Series 44 Bodies described above . . . plus a shelf-equipped superstructure, available with or without roof.

SERIES 480 Bodies, designed for light duty construction and maintenance work, are equipped with a revolving aerial ladder, an underfloor winch, and an easy-to-use derrick.

SERIES 44 Bodies . . . in 75", 90", and 104" lengths . . . are designed for service work in any phase of the utility industry. Equipped with bins, racks, material hooks, and adjustable shelves. Available with optional items to fit individual work needs.

Descriptive literature and price information is yours for the asking

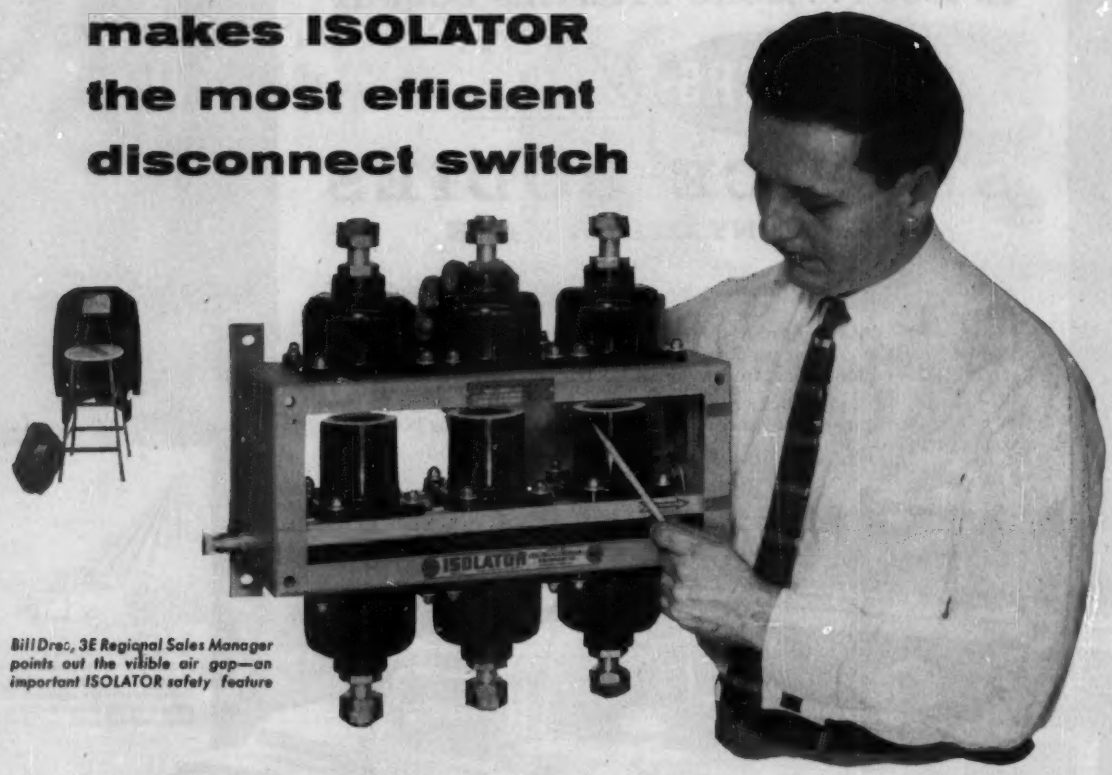
UTILITIES EXPECT MORE FROM POWERS American

McCABE-POWERS

AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. 625 CEDAR ST. • BERKELEY 10, CALIF.

Straight line action makes ISOLATOR the most efficient disconnect switch



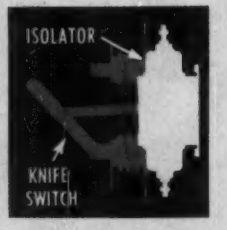
Bill Droc, 3E Regional Sales Manager points out the visible air gap—an important ISOLATOR safety feature

ISOLATORS save on cubicle construction and floor space because they take about ⅓ the space required by equally rated knife switches. They also weigh less and as all elements, including poles, are mounted and aligned on a rigid frame at 3E, they are simple to install.

ISOLATORS are safer ... in the open position, the gap between the bushings is easily visible. Yet the opening is narrow enough to lessen the chance of accidental contact with the live parts. The exposed studs at top and bottom are arranged for easy taping. When your men work in cubicles equipped with ISOLATORS they will be safe from live part hazards.

This switching center, designed and built entirely by 3E, shows how ISOLATORS make a compact, functional and handsome unit. These are, 5 KV, 200 ampere ISOLATORS. The ISOLATOR is also ideal in combination with potheads; any number of arrangements are possible and the units are easily interchanged if necessary. 3E makes many kinds of indoor and outdoor switches, and has a staff of engineers experienced in designing complete units for all types of special applications.

When the ISOLATOR moves from closed to open position its current carrying parts move in a straight line and telescope as contact is made. The parts are enclosed in insulated bushings which also telescope, shielding live parts and eliminating flash barriers.



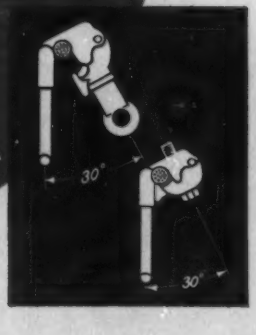
On your next switching problem, See 3E for recommendations and estimates.
For ISOLATOR data ask for Bulletin 140

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

3E

GREATER PROTECTION

FOR YOUR MAINS...



ANDERSON

STIRRUP CLAMPS

- ✳ NO CONDUCTOR ARCING DAMAGE ...NO PITTING...NO BURNING
- ✳ QUICK EASY INSTALLATION
- ✳ POSITIVE, EFFICIENT TIGHTENING WITH "HOT STICK"
- ✳ LARGER CONTACT AREAS
- ✳ LONGER TROUBLE-FREE SERVICE

CABLE RANGE: From #8 to #954MCM with four clamp sizes. Stirrup loop diameters (both aluminum and copper)... #4, #1, 1/0, 2/0, 4/0 and ½".

ONE PIECE "hook-over" clamp body, cap and eye are high-strength cast aluminum alloy. Stirrup loops are deep-serrated and compression-bonded into clamps... can't pull out! All component parts are triple-tested for rugged dependability!

FOR MORE COMPLETE INFORMATION consult your nearest ANDERSON representative or contact our home office.

ADEQUATE WIRING SERVES AND SAVES

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION & DISTRIBUTION

ANDERSON ELECTRIC

CORPORATION

BIRMINGHAM 1, ALABAMA

*Formerly Anderson Brass Works, Inc.

© J. H. Baxter & Co. 1956

"A hundred twenty five foot long!" Babe, the Blue Ox, dropped the tape off her left horn as Paul Bunyan whistled in amazement. His breath leveled nine young saplings. "Babe, that there's shore some Douglas Fir pole. An' she's jest as smooth an' round an' straight as the legs of a Barbary Coast dancin' gal...Babe, I *know* this'n is a BAXCO Douglas Fir Pole* —without lookin' at the brand."

BAXCO
(pressure treated)
DOUGLAS
FIR POLES

* But it's a good idea to look for that BAXCO brand, Paul... because it means the poles were cut from choice stands (mostly our own) of Coast type Douglas Fir timber—where trees grow extra tall and straight...it means the poles were carefully seasoned, inspected, machine shaved and machine incised full length before careful pressure treatment...and when you specify "BAXCO Douglas Fir Poles" of any size, you are assured of prompt service and rigid adherence to specifications. Inquire today.

PRESSURE TREATMENTS AVAILABLE: *Creosote, Chemonite, Pentachlorophenol, in accordance with Federal and AWPA specifications.*

J. H. BAXTER & CO. *120 Montgomery Street, San Francisco 4, California*

NEWS-SCOPE

FUTURE NEWS ▶

Electric companies may have to revamp plans for power reactor projects. The recent AEC policy statement giving priority to large-scale plants is forcing companies to take another look at their intentions of building seven to ten small reactors (in the 20-50-Mw range.)

Keep your eye peeled for more system tests of two air raid alarm systems (120 cycle and 540 cycle) to send controlled signals over electric distribution lines to trigger alarm receivers in offices and homes.

Utility managements look to January weather to boost winter peak loads. Because of mild weather conditions in December, 1956, these peaks continued generally upwards but did not show expected growth. Watch next week's issue for a survey of December peaks.

LATE NEWS ▶

Electric utility output for week ended Dec. 29 was 11,196,000,000 kwhr, an increase of 4.6% above the same week last year. Excluding Atomic Energy Commission requirements, the output increase was the same.

Chelan County PUD (Wash.) has decided to pay $103,644 in "privilege" taxes claimed due since 1952 on sale of wholesale power rather than contest a suit filed by Washington State Tax Commission. PUD had collected the tax but previously planned to withhold payment until its legality was determined.

A bill to help support California schools by taxing government-owned public utilities will be proposed to the 1957 state legislature by Assemblyman Sheridan Hegland, La Mesa Democrat. He declared that adoption of the bill would also provide more fair competition between taxpaying privately owned and tax-free public utilities.

SEC has postponed from Feb. 4 to March 18 scheduled hearings involving acquisition of stock of Ohio Valley Electric Corp by AG&E, Cincinnati G&E, Kentucky Utilities, Louisville G&E, Ohio Edison, and West Penn Electric, and also OVEC acquisition of its subsidiary, Indiana-Kentucky Electric.

AEC scientists have discovered a new kind of nuclear reaction that yields energy—the "catalyzed nuclear reaction." It is similar to a thermoculear reaction but, in contrast, can be performed at any temperature. While the new reaction results in the release of 5.4 million volts of energy, it lasts for only a two millionth of a second. No way is foreseen at present to prolong the reaction to make it commercially feasible.

Five North Dakota power suppliers—three utilities and two cooperatives—have signed a pact designed to serve as a guide in power distribution and to encourage mutual consultation so that the state's electric service may expand "in the best interests of the public" and "with a minimum of conflict."

Ralph D. Stauffer, president of New England Gas & Electric Service Corp since April 1956, died suddenly at Cambridge on Dec. 31. Stauffer, 58, was also chief engineer for 15 years of parent New England G&E Association.

As Congress convenes, two Republican vacancies on the Joint Committee on Atomic Energy have to be filled. Possibilities are Rep J. A. Jenkins (Ohio) to replace the late Carl Hinshaw of California, and Sens Henry Dworshak (Idaho) and Wallace Bennett (Utah) to succeed Sen Eugene Millikin (Colo.)

ELECTRICAL WEEK

A TWO-MINUTE

PROBLEM NO. 1 ▶ **Right-of-way and site acquisition is number one problem** for many electric utilities. In tackling it, the utilities are turning to underground facilities, higher voltage distribution, aerial cable, simpler R/W forms, and booklets explaining need and use of space sought. Some are studying possible legislative or regulatory revisions that would alleviate some phases of the problem. You'll find a complete rundown of right-of-way and site acquisition problems and practices by 84 utilities in exclusive Electrical World survey article in this issue. You'll also find how some of these utilities are obtaining and training right-of-way men (p 47).

EVENTS ▶ **Fuel prices going up.** That's gist of a roundup on the fuel outlook for the year ahead. The Middle East situation puts the squeeze on oil edging up price on Bunker C at a faster pace than for other fuels. Spring coal price boost expected. Gas may up its percentage of utility market (p 40).

Twenty-year-old college student appears serious in proxy fight with Union Electric management (p 46) . . . Electronic manufacturers outbid utilities for engineering students, says Purdue professor (p 46).

Consolidated Edison's Adequate Wiring program is beginning to snowball says C. Wesley Meytrott, assistant vp in report on the three-year-old project. He concludes that higher available capacities at service entrance speeds residential load growth (p 44).

GENERATION ▶ **First commercial-scale steam station designed specifically to burn fluid coke** is now under construction by Delaware P&L. With an expected station heat rate of 8,700 Btu per kwhr, the 50-Mw plant will be operated in conjunction with a new refinery of the Tidewater Oil Co. The refinery will furnish the power plant with fuel, treated water, and cooling water. It'll get back power and process steam. Knottiest engineering problems presented dealt with the fly ash which has higher fusion temperatures than ordinarily encountered and with design of the coke pulverizers to turn out extremely fine powder (p 60).

Put a 20-ft U-blade on front of a powerful tractor and you can move 19-20 tons of coal at a push. Consumers Power Co had this material handling equipment designed to keep the coal stockpile in shape at its B. C. Cobb Plant (p 66).

ATOMIC PROGRESS ▶ **Of the 59 nuclear reactor units under construction or under contract,** 29 are power-type reactors, says Atomic Industrial Forum in year-end roundup. Of the power-type reactors, 14 will go into naval vessels, six are for land-based non-federal demonstration, four are AEC units, four are for export, and one is for propulsion of a merchant vessel. AEC lab units are not included (p 43).

TRANSMISSION ▶ **When Dayton P&L Engineers were faced with cramming a 138-kv line** into a highway right-of-way too narrow for H-frame construction, they came up with a single-pole design to support 1,351,500 circ mil aluminum conductors. Real novelty of the design is the braces, adjustable at both ends, to support cross arms (p 57).

DISTRIBUTION ▶ **Engineers will find a way.** To run a centerline survey through trees and brush between points two-miles apart, Toledo Edison surveyors hitched a plumb to a helium-filled ballon, took a transit reading from the starting point as the ballon was manuvered directly over the terminal point (p 63).

RELAYING ▶ **Half-million dollar system relay modernization program at Toledo Edison Co** has reduced number of incorrect breaker operations and length of voltage depressions to improve customer service. High-speed reactance type relays have replaced phase overcurrent directional back-up relays, and high-speed over-

current direction relays have replaced overcurrent directional ground relays on 69-kv circuits. On substation buses and transformers, differential relaying has been added. On 34.5-kv circuits, impedance-type relays have replaced phase overcurrent directional relays, and high-speed overcurrent directional relays have replaced ground relays (p 58).

METERING ▶ **Custom-design voltmeter test table at Houston Lighting & Power** simplifies and speeds meter testing. Transformer used has a 240-v primary and supplies testing voltages at 10, 20, 80, 160, and 320-v. It's said to be accurate to within 0.01% of marked secondary voltage (p 70).

SELLING ▶ **"Live Better . . . Electrically" is busting out all over** the Potomac Edison territory reports Promotion Manager C. D. Lyon. In case-history study of the LBE program at Potomac Ed Lyon says dealers display "extreme enthusiasm" toward utility's efforts. LBE serves as unifying theme for other special promotions (p 74) . . . New plating technique for putting aluminum plate on plastic spotlight reflectors is being used by a Kansas City P&L industrial customer. Heating requirements for the process total 15 kw (p 83).

MANAGEMENT ▶ **Interest rates will continue at high level for next few months** and may even edge up a bit from late 1956 . . . Electric utilities will be floating $225 million in new securities this month . . . Halsey Stuart & Co calls Niagara Mohawk Power on use of negotiated rather than competitive bid for selling debentures . . . PG&E trims rates by over $500,000 annually . . . Seattle City Light asks for temporary rate to enable it to dispose of surplus hydro energy (p 109).

Electric utilities must take the initiative to get the trained engineers they need concludes Dr Loyal V. Bewley, Lehigh University Dean of Engineering. To put some life into college power engineering courses, Bewley suggests that the industry subsidize professorships and provide competent teaching authorities, help supply up-to-date laboratory equipment, endow scholarships, and arrange for closer liaison with college teachers and students. You'll find a suggested 5-year curriculum and some penetrating reasons for the current deterioration of college power courses in an article that's sure to make utility management listen and a lot of engineering professors mad (p 54).

PEOPLE ▶ **Loftin Johnson is new operating vice president at Florida P&L,** moving up from manager of electrical operations . . . R. E. Doyle, Jr, joins Indiana & Michigan Power to become vice president and assistant general manager. Doyle was previously a vp at Kentucky Power and is being succeeded there by F. M. Baker . . . Walter S. Bencher is elected president at Combustion Engineering (p 112).

MANUFACTURERS ▶ **Sales outlook good to excellent for the year ahead say 15 electrical manufacturers** in reply to EW query. Orders should range 5% to 35% above 1955 with transmission and distribution equipment makers most bullish . . . Ingersoll Rand Co gets $1.3-million contract for main steam condenser and circulating water pumps for Con Ed's nuclear plant . . . Pennsylvania Transformer Co teams up with Bart-Messing Corp to supply packaged rectifier equipment (p 99).

NEW EQUIPMENT ▶ **Quieter-type boiler feed pump motors are now available** in 1,000-hp ratings and up to speed of 3,600-rpm. Designed to cut plant noise, the motors have stiffer stator frames, sound-absorbing material, and baffles to tone down both high and low frequency sounds . . . Fully insulated bushings on new distribution transformers should cut outages caused by birds, pets, and animals shorting across terminals as well as afford additional safety to linemen (p 86) . . . New type heavy truck-mounted crane is suitable for construction and materials handling in utility field (p 87).

ENGINEERING TRENDS

Sunshine will generate the steam for a 1,200-kw turbine in the Armenian desert, according to Russian claims reported by Science Digest. Solar energy at the site approaches 8 million Btu per sq yd during 2,600 annual hours of sunshine. Large mirrors with 24,000 sq yd of reflective surface will automatically concentrate the sun's rays on a tower-mounted boiler. Underground accumulators will store heated water for plant operation during periods of darkness.

Polypropylene will insulate low-voltage cables of the future. Now in pilot-plant stage, its toughness and flexibility even at low temperatures, negligible absorption of water, high softening temperature, and resistance to abrasion will enable use without a protective jacket.

Tilt remains troublesome to metermen. One engineer checked a sample group of watthour meter installations and found 76 out of 120 tilted 1 to 4 deg from horizontal. Five years ago this month (Jan. 28, 1952, p 166) Electrical World flagged this threat in reporting tests by K. R. Weigand, Indiana & Michigan Electric Co.

Pole-top space is at a premium these days. A growing number of distribution engineers are finding vault and hand-hole installation of shunt capacitors attractive. Watch for manufacturers to recognize this trend by introducing a 4-kv capacitor with its live parts in a special submersible terminal enclosure for "buried" installation.

FROM EDITORS IN THE FIELD

Cost of computing data for transmission substation daily load curves is cut by punching half-hour log readings directly from station log sheets to key punch cards. Los Angeles Dept of Water & Power extracts data from these cards with an IBM 604 to compute megawatts, megavars, megavolt-amperes, and power factor for individual stations and for the system.

Line-extension paper work has been cut by a western utility. Under the simplified procedure, extensions are now designed and built within 10 days which formerly required about a month. Estimates are based on sketches, and material is drawn out according to brief specifications by the field engineer. Jobs costing $1,000 or less, exclusive of transformers, are charged against a special account budgeted annually rather than individually authorized by management. The new plan has been applied to about 70% of overhead extensions with such satisfactory experience that it may be extended to underground.

Distribution engineers are expressing concern over load characteristics of refrigerating equipment used for bulk milk tanks on dairy farms where tank trucks make periodic pick-ups. Direct-expansion cooling requires intermittent operation of a 5-hp motor and gives about 20% load factor. "Ice bank" equipment uses 1½-hp motors more nearly continuously and has 78% load factor. Near-coincident starting of 5-hp motors could be troublesome.

Why wait for EHV benefits?

We're ready now to help you go ahead with Extra-High Voltage Transmission

No longer is a "wait-and-see" attitude the practical approach to whether or not to use extra high voltage transmission.

If you can use the economies and other benefits possible with extra high voltage, you can go ahead with your plans right now. Generally, the major problems on EHV transmission have already been solved. Answers have been obtained through actual experience in this country and abroad, and they've been obtained in the laboratory.

The Ohio Brass extra high voltage laboratory has led the way on EHV research with comprehensive studies of electrostatic shielding arrangements, tower flashover, bundled conductors, contamination and other highly important phases of EHV transmission. We know, for example, that present designs of insulators and hardware can be readily adapted to even higher transmission voltages than are now being used.

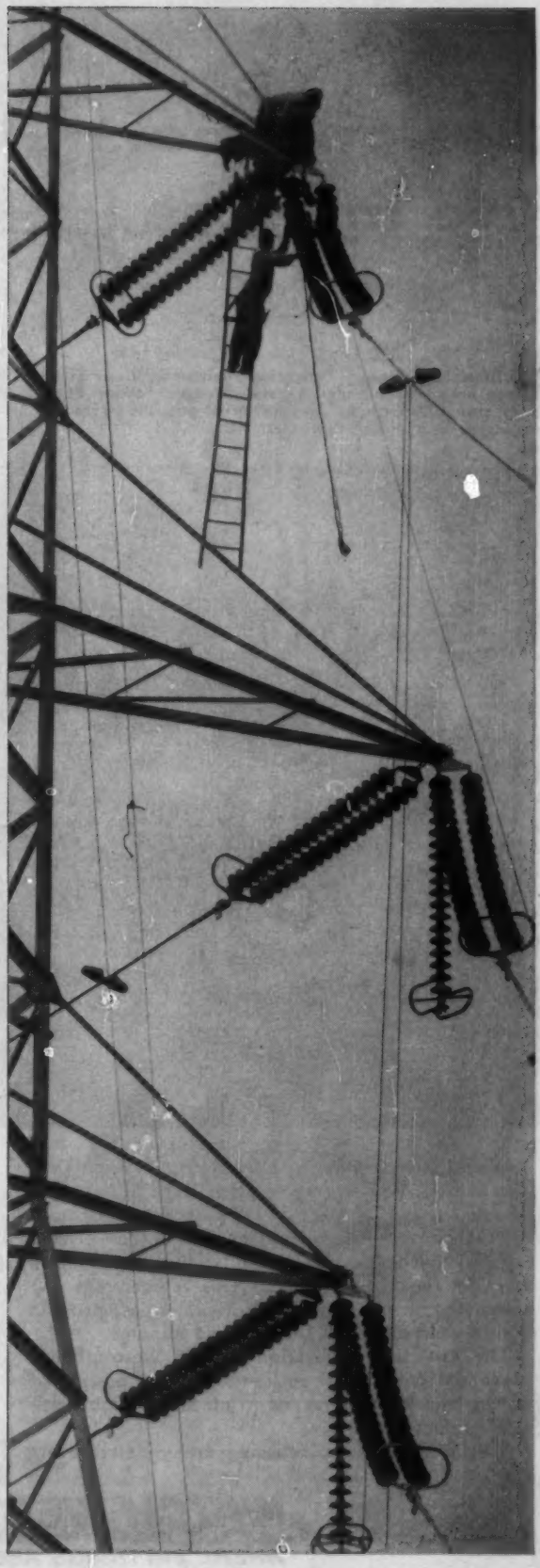
We're prepared to help you relate our findings to your operating conditions. And if you have some special problems, our laboratory facilities and experience are available to help you solve them.

So why wait to get the benefits of extra-high voltage transmission in your system? We're ready to help you go ahead—NOW!

OHIO BRASS COMPANY, MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass



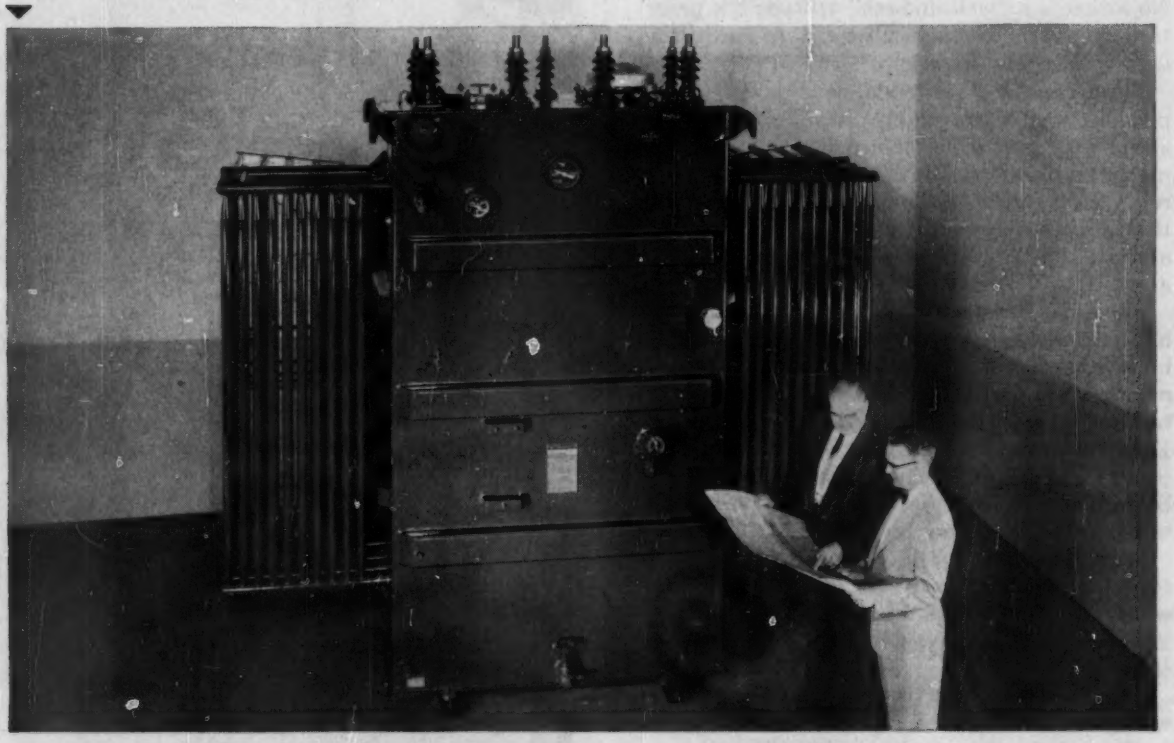
O-B insulators and control devices were used extensively on this EHV line.

4741-H

Design time... five minutes

WESTINGHOUSE ENGINEERS are now designing mathematically perfect power transformers with new IBM-705 electronic computers . . . in minutes.

J. C. Rissinger, Manager Substation Equipment Sales, reviews design improvements with Gordon Monroe, Section Mgr., Engineering Department . . . many made possible by freeing engineers from routine design calculations.



Automation has come to transformer design. Two new Westinghouse computers telescope design time to just short of nothing. That's important because designing a well-balanced transformer has been a complex and time-consuming job. Now, such factors as impedance, losses, sound level, temperature rise and dielectric strength are all integrated into product design—automatically, literally in 5 minutes.

The exclusive application of this Westinghouse pioneered innovation to the complete design of power transformers means products of mathematically perfect quality.

Specification and purchasing are simpler. Exact design information is right on hand at the time the order is negotiated. Eliminating 99% of our design time means you get faster delivery.

The time of, literally, dozens of engineers is being made available for creative development work on new and better transformers. Even when product performance already represents industry leadership, you can depend on Westinghouse to introduce new ideas that make any Westinghouse transformer a better buy.

Get in touch with your Westinghouse sales engineer, today, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70767-X

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

4,000,000' of TRIANGLE Trioprene Underground Cable

Four million feet of cable may seem like a lot to bury in the ground—but not to Con Edison. That's only a part of their expansion program to meet the power demands of growing New York. Today's demands and *tomorrow's.*

Secondary network cable is so important a part of their distribution system, Con Edison engineers require a product which will operate satisfactorily under the conditions that exist in their underground system.

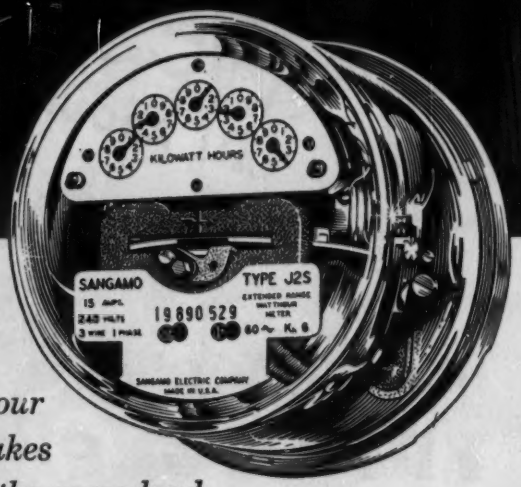
Triangle Trioprene Secondary Network Cable answers this demand. It is insulated with a low moisture absorption rubber compound and protected with a tough, heavy duty jacket, resistant to heat, sunlight, moisture, abrasion, oils, grease, acids, alkalis and most solvents. Because of the excellent aging characteristics of the Neoprene Jacket, it retains its protective qualities for long periods of time even under adverse conditions.

Get all the facts on Triangle Trioprene—write today for literature.

It Must Be Right
The Trade Mark of TOP Quality
TRIANGLE

TRIANGLE
Conduit and Cable Co., Inc.
NEW BRUNSWICK, NEW JERSEY

the slow speed of the Sangamo J2 watthour meter adds years to its life



SLOW SPEED... that's one difference between the Sangamo J2 and other watthour meters. The disk of the J2 makes fewer revolutions to measure the same load.

What the J2's fewer revolutions mean in terms of one year's time...

The disk of the J2 revolves 166⅔ times to measure one kilowatt hour. Other meters make 277.7 revolutions to measure a kilowatt hour.

This year's average residential load will be approximately 3000 kilowatt hours. If you multiply this figure by 277.7, you get 833,100 —the number of revolutions a 3.6 constant meter makes in measuring 3000 kilowatt hours.

When we multiply 3000 kilowatt hours by 166⅔, the speed of the J2, we get 500,000. The difference between 500,000 and 833,100 is 333,100. In other words, the J2 makes 333,100 *fewer* revolutions in a year's time to measure the same load! 333,100 *fewer* revolutions to cause wear on moving parts. Think what it would add up to in 30 years!

That's why we say "the slow speed of the Sangamo J2 adds years to its life."

JM56-1

SANGAMO ELECTRIC CO.

SPRINGFIELD, ILLINOIS

Wisconsin Electric Power Company chooses ALCOA ALUMINUM heat exchanger tubes for this big surface condenser

Saves over 50% on tube costs, reports excellent service

This 105,000 sq ft surface condenser at Wisconsin Electric's No. 3 power unit, Oak Creek, Wisconsin, is the result of more than four years of tests with ALCOA® Aluminum Heat Exchanger Tubes. It is believed to be the first utility company surface condenser of its size to be fitted with aluminum tubes. Development work was handled jointly by ALCOA, Allis-Chalmers and Wisconsin Electric engineers.

The project was started in 1950 when ALCOA Aluminum Tubes were spotted in various locations and later evaluated. Initial cost savings were evident at once. Cost studies proved aluminum tubes save more than 50% in initial costs compared to admiralty.

Aluminum's superior resistance to ammonia, carbon dioxide and hydrogen sulfide is important in avoiding corrosion in the air cooler sections of the condenser. This natural corrosion resistance and the valuable dollar savings afforded by aluminum weighed heavily in the final decision to use ALCOA Aluminum Heat Exchanger Tubes. Excellent performance of the aluminum tubing in continuous service since December, 1955, has proved that decision sound. Now Wisconsin Electric plans to use ALCOA Aluminum Tubes for a second unit to be placed in operation during 1957.

For more than 30 years, ALCOA Aluminum Tubes have been used successfully in condensers and heat exchangers. The Wisconsin Electric installation demonstrates why this general acceptance has developed—the excellent properties of aluminum alloys, ALCOA's cooperative research and development programs to establish sound applications, and industry's desire for a good product at a reasonable price.

For full information on ALCOA Aluminum Heat Exchanger Tubes, write to ALUMINUM COMPANY OF AMERICA, 887-A Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

Now . . . most power of the low-priced 3

New DODGE *PowerGiants*

1957 line-up gives you up to 232 hp.

Dodge tops the low-priced field in V-8 power by a big margin—actually delivers as much as *31% more!* This *extra* power in reserve saves engine strain . . . wear . . . excessive repairs. What's more, Dodge V-8's use *regular* gas, help keep your cost per ton-mile *down!*

Extra payload capacity. You can haul more—up to 73% more in the 300 model pick-up, for example.

Extra handling ease. Exclusive push-button automatic transmission*! Sharpest turning and easiest steering in the industry!

See the new *Power Giant* line-up now at your Dodge dealer's. You'll see features that prove it pays to get your Dodge dealer's deal before you decide on *any* truck.

**Available on all low-tonnage and Forward-Control models.*

DODGE meets your hauling needs!

Conv. Models	Max. G.V.W.	Max. G.C.W.	Max. V-8 HP.
100	5,100 lbs.	—	204
200	7,500 lbs.	—	204
300	8,800 lbs.	—	204
400	15,000 lbs.	26,000 lbs.	197
500	18,000 lbs.	32,000 lbs.	197
600	21,000 lbs.	35,000 lbs.	197
700	23,000 lbs.	45,000 lbs.	216
800	25,000 lbs.	55,000 lbs.	222
900	30,000 lbs.	65,000 lbs.	232
Forward-Control Models			
P300	9,000 lbs.	—	204
P500	15,000 lbs.	—	204
C.O.E. Models			
C500	18,600 lbs.	32,000 lbs.	197
C600	21,000 lbs.	35,000 lbs.	197
C700	22,500 lbs.	45,000 lbs.	216
Tandem Models			
T700	32,000 lbs.	45,000 lbs.	216
T800	36,000 lbs.	55,000 lbs.	222
T900	46,000 lbs.	65,000 lbs.	232

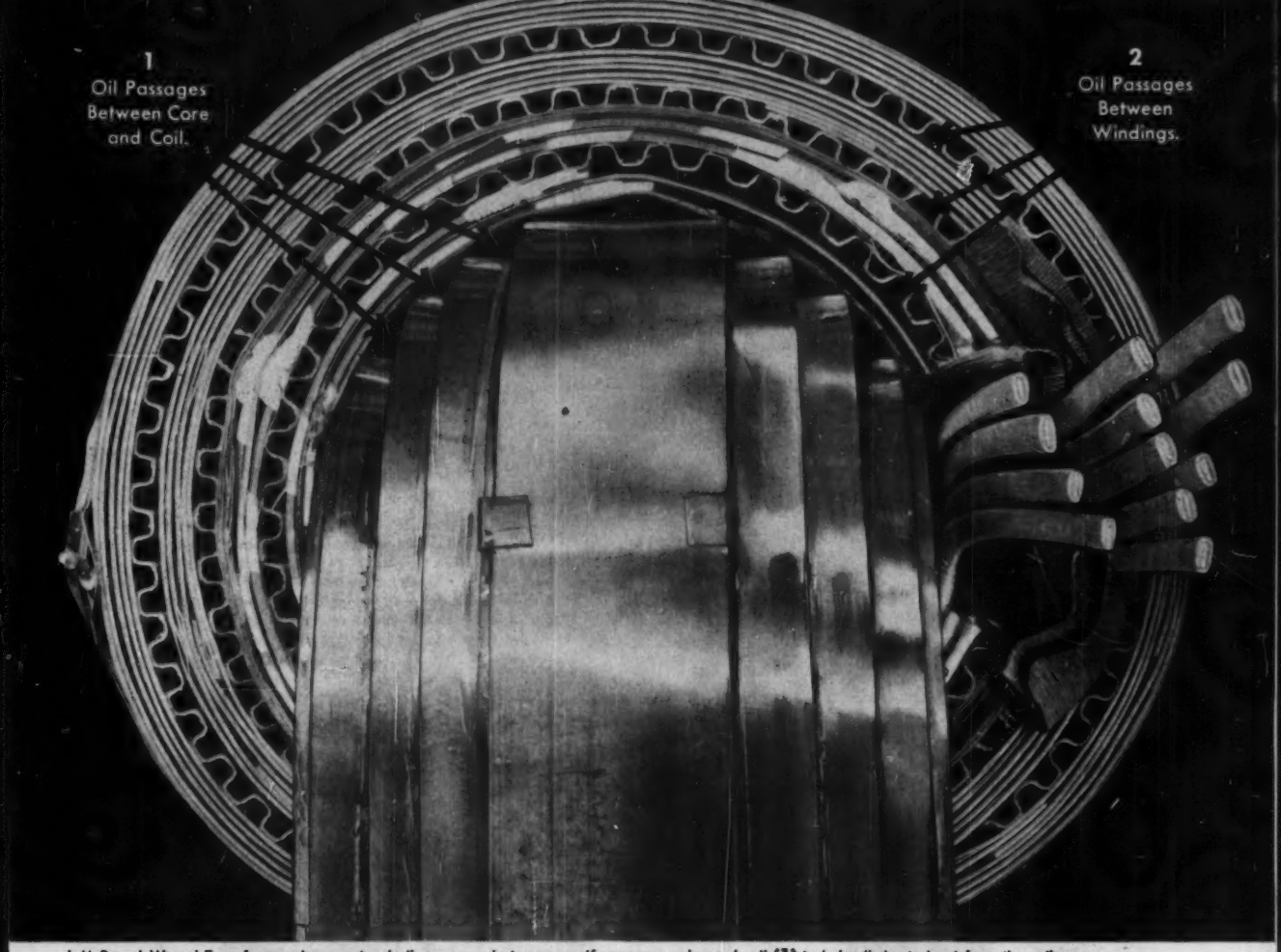
DODGE TRUCKS

WITH THE *FORWARD* LOOK

Pick-ups

Stakes

Tractors



L-M Round-Wound Transformers have natural oil passages between cruciform core and round coil **(1)** to help dissipate heat from the coils more rapidly. In addition, ducts provided by spacers placed between windings **(2)** and between layers in most sizes provide additional oil circulation.

Why More Customers Are Selecting L-M Round-Wound® Transformers

Many factors enter into transformer selection. Here are some of the reasons for the great increase in customer preference for L-M's obround-shape Round-Wound transformers.

Balanced Performance: The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

Higher Uniform-Impulse Level: Round coils are wound into shape. Therefore, insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

Higher Short-Circuit Strength: Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

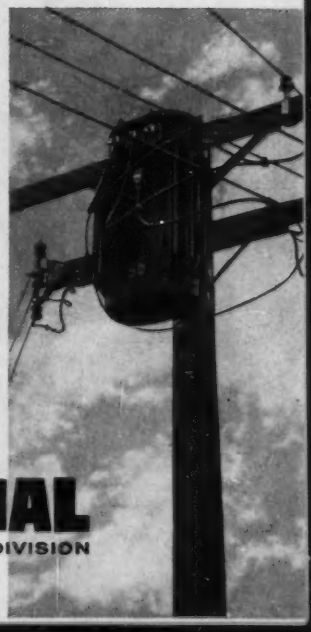
Higher Short-Time Overload Capacity: Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

Additional Capacity on Pole: L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces bending moment on the pole and crossarms, and thus greatly increases potential capacity of existing transformer structures.

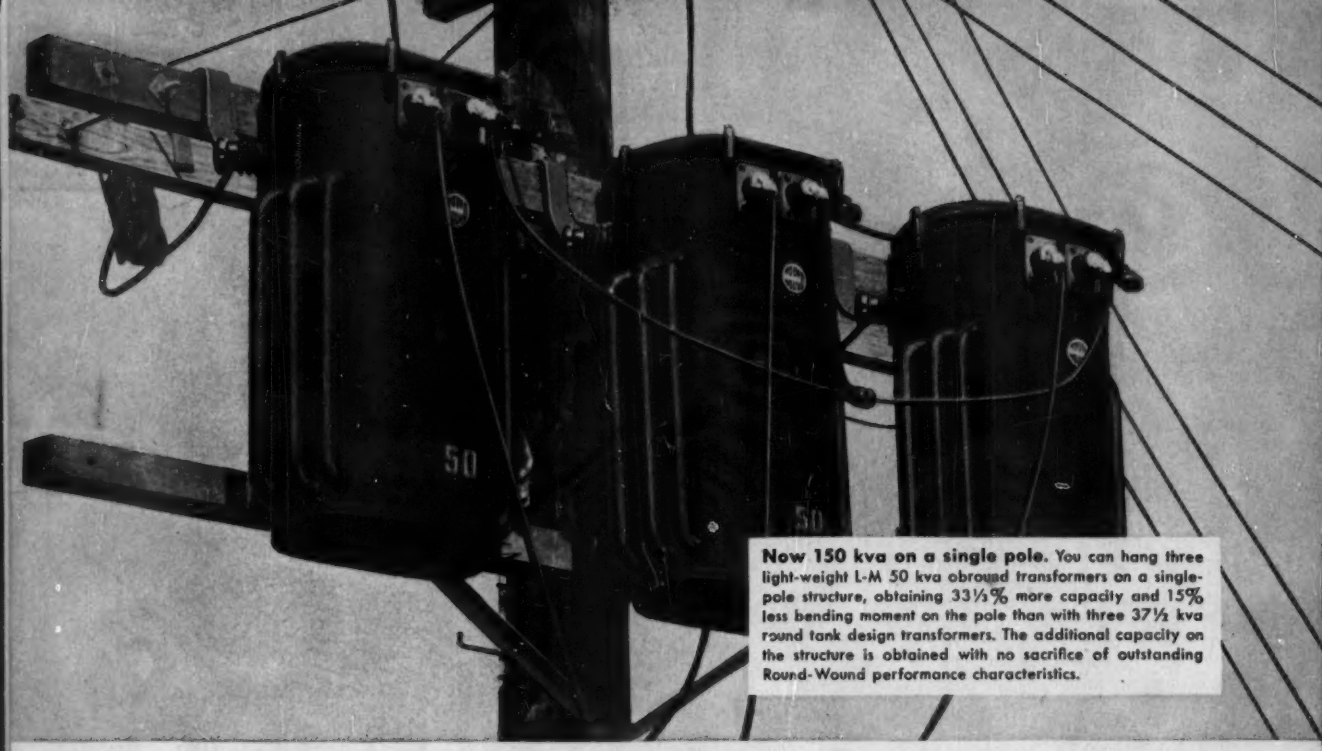
Get Complete Information

Ask your L-M Field Engineer for complete information and bulletins on L-M's Round-Wound Transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

285

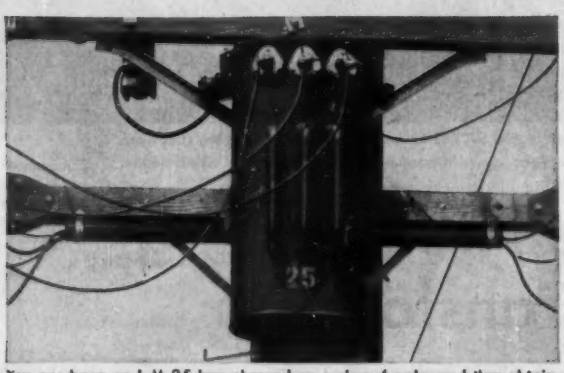


LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION

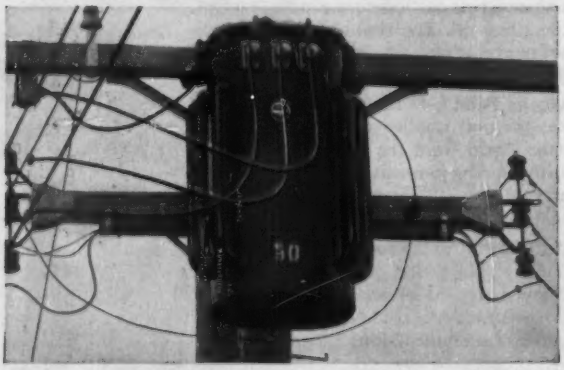


Now 150 kva on a single pole. You can hang three light-weight L-M 50 kva obround transformers on a single-pole structure, obtaining 33⅓% more capacity and 15% less bending moment on the pole than with three 37½ kva round tank design transformers. The additional capacity on the structure is obtained with no sacrifice of outstanding Round-Wound performance characteristics.

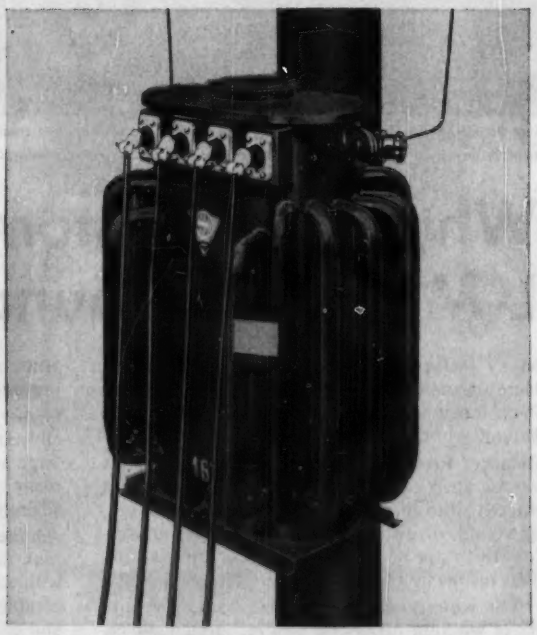
How L-M's Obround Transformer Design



You can hang an L-M 25 kva obround on a class 4 pole, and thus obtain 66⅔% increase in capacity with very little increase in bending moment over a 15 kva round tank design transformer.



You can pole-mount an L-M 50 kva obround transformer and thus obtain 33⅓% more capacity and 15% less bending moment on the pole than with a 37½ kva round tank design transformer.



The light-weight L-M obround 167 kva transformer can be single-pole mounted. In addition to being exceptionally quiet, the overload capacity, regulation, and other Round-Wound characteristics have been fully maintained in this new design.

LINE MATERIAL

A McGRAW ELECTRIC COMPANY DIVISION

Now 500 kva on a two-pole structure. You can hang three light-weight L-M 167 kva obround transformers on a two-pole structure, obtaining 66⅔% more capacity and less bending moment on the pole than with three 100 kva older-design transformers.

Cuts Your Construction Costs

Now you can hang larger-capacity transformers on a pole. Transformer is smaller, lighter, and has shorter moment arm; retains all outstanding Round-Wound® performance characteristics.

By **ALVIN B. COYLE**
Product Manager
Transformers
Line Material Company

The potential capacity of all your transformer structures is greatly increased when you specify Line Material's lighter, smaller, obround transformer. You can now hang three 50 kva transformers on a single-pole structure instead of three 37½'s; or three 167 kva transformers on a two-pole structure, with less bending moment than with three 100 kva older-design transformers.

Less Weight

The new obround design has a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Additional cooling tubes compensate for the reduced tank size and provide adequate cooling surface. Transfer of heat from the copper to outside air is faster and more efficient because of reduced mass.

Shorter Moment Arm

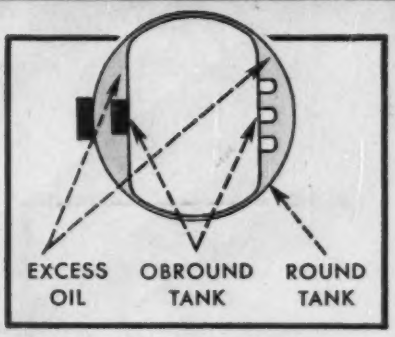
L-M's obround design brings the center of gravity closer to the pole, which reduces the moment arm distance from the pole. The combination of less weight and shorter moment arm distance substantially decreases the total bending moment on the pole and crossarms, and thus greatly increases the potential capacity of all your transformer structures.

Round-Wound Performance

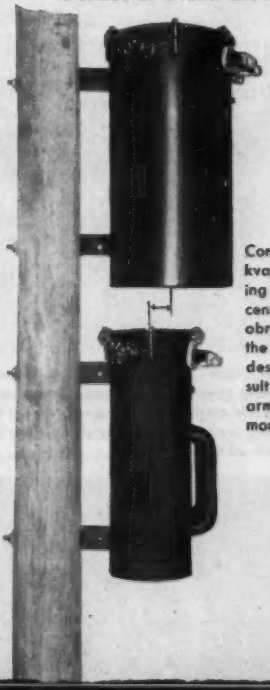
The additional capacity is accomplished without changing L-M's outstanding Round-Wound performance characteristics. These characteristics include low exciting current, low noise level, high impulse strength, high short-circuit strength, high short-time overload capacity and many others.

Get Details on L-M's Obround Transformer

Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and L-M's exclusive Round-Wound design. Or write Line Material Company, Transformer Division, Zanesville, Ohio.



L-M's obround design has less transformer oil. Additional cooling tubes provide adequate cooling. Transfer of heat from the copper to outside air is faster and more efficient.



Comparison of two 25 kva transformers, showing how much closer the center of gravity of the obround design is to the pole than the round design, above. The result is shorter moment arm and less bending moment on the pole.

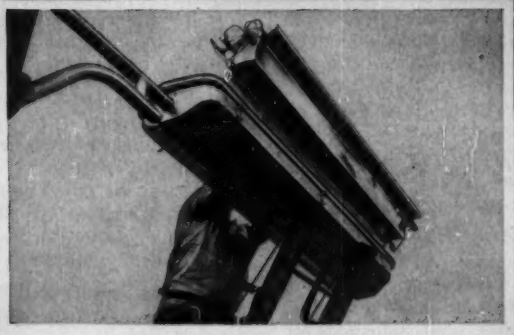
Transformers

252

"NOTHING TO IT!...Putting Up the

CARL HAWKINSON
Superintendent
Edwards Construction
Company
Geneseo, Illinois

"Nothing to it," says "Swede" Hawkinson. "First, slip the aluminum housing over the 2-inch support member and turn the housing *upside down*. Easy going—you're on top of the job, and in good working position—not underneath, working up like you are on other units."



"Hook up the primary. Terminals have tin-plated pressure-pad connectors to speed up the installation. The reflector assembly mounts on the housing with just three cotter-type hinge pins. Now, flip the reflector open to connect the leads. And see how the friction-type connectors save time."

LM®

LINE MATERIAL

A McGRAW ELECTRIC

New L-M Fluorescent Luminaire Is Easy!"

That's the word from Carl "Swede" Hawkinson. "Nothing to it . . . one man can do the job. All you need is a screwdriver, a crescent wrench, and a level."

For a fact, the new L-M fluorescent luminaire is *remarkably* easy to install. You will understand why, as you study the photographs and explanation by "Swede" Hawkinson, competent and well-liked superintendent of the Edwards Construction Company, Geneseo, Illinois.

And bear in mind—this easy-to-install design by L-M offers *many* exclusive engineering advantages. In addition, L-M's new fluorescent luminaires present a *new look* in street-lighting equipment. They are styled for handsome appearance, correct light distribution, and a lifetime of efficient, economical operation.

Outstanding Features of L-M's New 1957-Style Fluorescent Luminaire

Shipping: Unit comes in two separate packages to make it easy to handle. The housing is in one package; globe and reflector assembly are in the other.

Housing: One-piece aluminum housing with reinforcing ribs provides strong, rigid mounting. Aluminum housing also provides excellent heat dissipation. Neoprene gaskets seal globe to housing and support entry, provide weatherproof construction.

Ballasts: Ballasts are mounted directly to flat inner surface of aluminum housing. This allows maximum heat dissipation during operation.

Ballast leads have friction-type terminals. Wiring is completed quickly and easily without tools.

4-lamp units have two ballasts, with one lamp from each side paired to each ballast.

Reflector: Two-piece reflector has separate, efficient reflecting surface for each lamp. Assembly is hinged and retained by spring-type latches to provide easy access to input terminals, ballasts, internal wiring, and mounting clamps.

Opening or removal of reflector assembly is accomplished without removal of lamps from their sockets.

Lamps: Only unit available today designed to take both present and future very high output (VHO) fluorescent lamps.

Globe: One-piece Plexiglas® globe is strong, virtually free from strain. Unit is latched and hinged to open from either side to provide easy accessibility for installation, wiring, cleaning, or relamping. "Breather" holes are provided in bottom of globe. Holes are covered with fiber glass filters to keep out dust and insects.

Wiring: Input terminals accommodate wire up to No. 4 stranded. They are tin-plated for use with either copper or aluminum conductor. Input circuit is arranged for operation on either 2- or 3-wire system.

Get Complete Information

Ask your L-M Field Engineer or Street Lighting Engineer for more complete information. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

"Next, turn the whole assembly 180° to normal position. Level and tighten up two interior clamping screws, and lock the reflector assembly in place with three twist-lock hasps. The two-piece reflector has separate reflecting surfaces for each lamp."

Shallow-type luminaire

Shallow type is available in 4- and 6-foot lengths to accommodate 2 or 4 lamps. The deep style shown in photos below is also available in 4- and 6-foot lengths. For other outdoor lighting applications, such as parking lots, store-front lighting, etc., other styles are available. L-M Street Lighting Engineers will cooperate with you in designing the best system for your area.

"All right! Now you put in the four fluorescent lamps, swing the globe assembly up into latched position, and the unit is ready to be fired up. The whole installation can be done in a matter of minutes. *Nothing to it!* . . . Putting up the L-M Fluorescent Luminaire is *easy!*"

Street Lighting

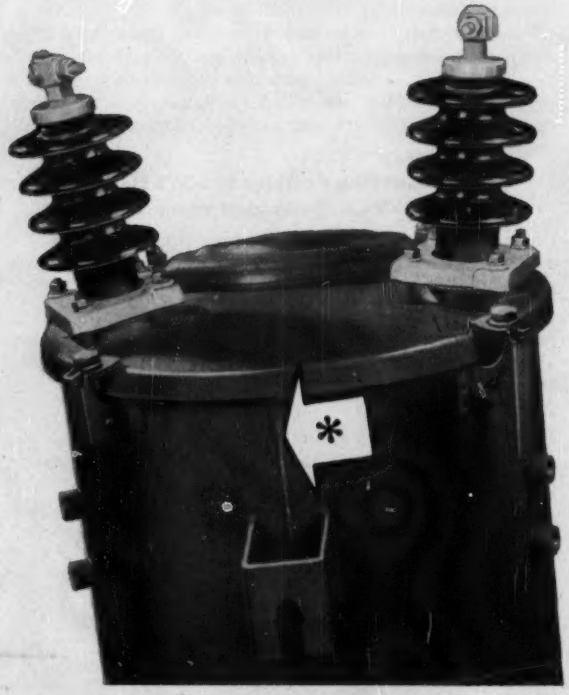
KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Michigan, you will receive a valuable gift certificate. Each week a different Kuhlman representative is featured . . . watch for the Kuhlman salesman who calls on you.

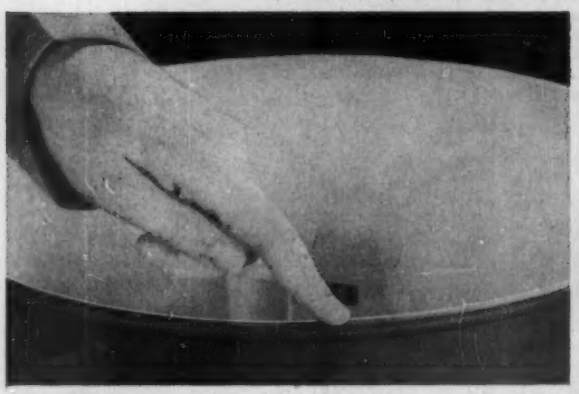
"LET ME SHOW YOU WHY

KUHLMAN TRANSFORMER TANKS ARE YOUR BEST BUY . . . . . ."

In my territory a distribution transformer tank must be leak-proof . . . air-tight . . . and rigid in construction. That's why my customers consistently order Kuhlman. They know every weld and seam of a Kuhlman tank has been factory-tested, under pressure, for oil tightness. And for all around service, they prefer Kuhlman's solid construction—moisture-proof cover fitting—and rounded tank bottom features. It will pay you to talk to your local Kuhlman representative about all the features that make Kuhlman distribution transformers your best buy.



* All welds, seams PRESSURE-TESTED



SPUN-OVER RIM—increases tank rigidity. Forms a smooth gasket seat for a moisture-proof, air-tight cover fitting.

ROUNDED BOTTOM—provides added tank strength . . . sheds moisture easily . . . forms a rugged bearing surface for handling and shipping.

KUHLMAN ELECTRIC COMPANY 575a

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

FOR SUPERIOR INSULATION AND JACKETING CHOOSE ALATHON® POLYETHYLENE RESIN

Jacketing of ALATHON®
— for greater durability
— for abrasion resistance
SHIELD
Insulation of ALATHON® for high dielectric strength and heat resistance

The unique properties of ALATHON polyethylene resins make them suitable for both jacketing and insulating applications. Jacketing of black ALATHON withstands conditions of heat, moisture, and weather extremes — assures years of trouble-free service. ALATHON absorbs the shocks of rough handling and thereby speeds installation.

The electrical properties of ALATHON polyethylene resins are excellent. Their low power factor and dielectric constant remain essentially unchanged over a wide range of frequencies and temperatures. Their moisture resistance and lightness of weight make them eminently suitable for insulating applications.

A complete family of ALATHON polyethylene resin compositions is offered by the Du Pont Polychemicals Department. For the compound best suited to your particular use, send for complete details by mailing the coupon below.

There is a difference in polyethylenes—

specify ALATHON®

polyethylene resin

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 481, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "ALATHON" polyethylene resins. I am interested in evaluating these materials for

.....

.....

*Name*_____ *Position*_____

*Firm Name*_____

*Street Address*_____

*City*_____ *State*_____

*Type of Business*_____

NEWEST WESTINGHOUSE TEST CENTER . . .

World's largest transformer laboratory to prove performance beyond 500,000

Here's a Westinghouse investment that is now adding value to every dollar you put into Westinghouse power transformers. In one vast new facility is a combined commercial and experimental testing laboratory at the Transformer Division, Sharon, Pa.

From this ultramodern laboratory, used primarily for research and development, will come transformers of the future. The new anechoic vault, for example, will make complete sound measurements to and beyond 500,000-kva ratings; find ways to throttle structural resonance; ferret out strengths and weaknesses of new core materials and processes; speed inquiry into new methods of reducing vibration and sound.

In the high-voltage laboratory, new insulation systems are being developed. Here, models — and full-scale transformers — are tested to destruction. This laboratory is equipped, in fact, to evaluate total electrical performance of the largest commercial units predicted for a decade ahead.

Here today is equipment that immeasurably strengthens the promise of performance in things to come — from Westinghouse.

J-70783

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

KVA

M. E. Fagan, Engineering Manager, Transformer Division, and model of world's most modern transformer laboratory at Westinghouse. Facilities include surge generators at 600,000, 4 million and 5 million volts; a 1,050,000-volt, 60-cycle test set for insulation; a 180,000-ampere impulse generator; a completely shielded sound chamber for radio interference testing of small power transformers and components.

"Time Teaches Many Lessons"*

*Aeschylus 540 B. C.

Ferdinand de Lesseps:

de Lesseps vision, the Panama Canal, inspired American engineers to titanic efforts—making the idea a reality. Tropical climate and terrain took a heavy toll in men and materials. But the lessons learned by a generation of canal builders—from 1882 to 1914—have never been forgotten.

In 1908, fifty miles of Kerite cable helped speed the completion of de Lesseps tremendous venture. Laid over jungle swamps and scarps, a thirty-mile length of this cable was submerged in the Gatun Lake. Based on the unfailing operation of the first cable, a second Kerite installation was completed in 1918. Time—more than 100 years of it—has taught successive generations of Kerite engineers that there can be no compromise with quality or integrity.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston; 4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio; 29 West Lancaster Avenue, Ardmore, Pa.

A Good Editorial Policy Is Always New

This is the first issue of a new Electrical World. As you turn the pages, you will notice new departments, new features, new type. Proud as we are of this newness, we are prouder still of our oldness—expressed not in time but in an editorial policy that has made it possible for us to serve the electrical industry for 83 years.

Under this policy we are dedicated to the objective of providing all of the significant news of the area which we serve. We believe such news helps our readers to do their work more easily, more quickly, more cheaply, and more efficiently.

But carrying out that policy has been far more complicated than the policy itself. To be successful in this, we have had to build an experienced staff which the industry would respect and to use all the skills and techniques of modern journalism.

We believe that we have succeeded. Our staff today consists of 22 fulltime editors. Most of these are experts capable of making worthwhile contributions to the industry. Reinforcing these men is the interconnected worldwide organization of the McGraw-Hill Publishing Co.

The immense amount of industry information gathered by our own and the company organizations would do little good if it were not handled with your interests in mind. Because we have been making reader surveys since 1946, we believe we know what you want. We claim to know how you want it presented.

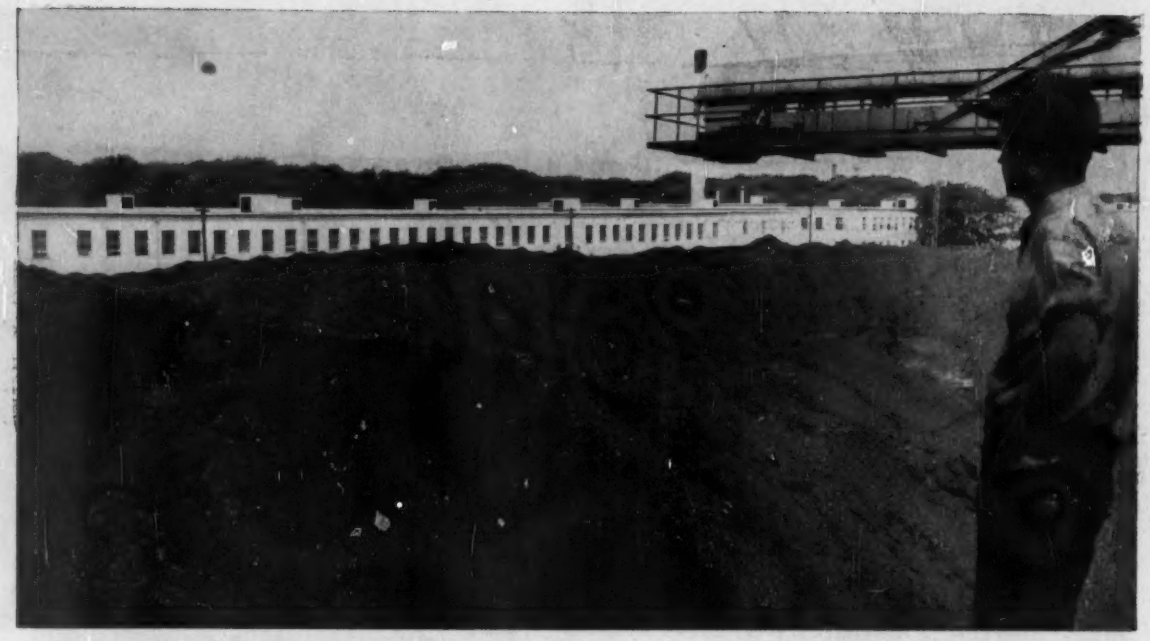
You will find that Electrical World is complete in its coverage of significant non-technical and technical industry activities. "Significant" is the key word in the last sentence. We make no pretense of reporting everything that happens in this vast electrical industry. Instead we select information of most value to our readers in their work. This selection we consider our responsibility.

However, we do not consider ourselves to be the greatest authority on electric company operation and practice. For engineering techniques we depend on those who are actively contributing to the progress of our industry from the operating or manufacturing company level.

We invite these men to contribute under their own "by-lines" the articles which are of so much help to their colleagues. From the time of Edison to today when so many men are advancing the art of electric generation, transmission, and distribution, Electrical World has been the authority on, and many times the first announcer of, these developments.

Don't just read Electrical World; study it. As you compare your own ideas with those of others, you will gain confidence in yourself. You will absorb the progressive thinking that leaders of this industry must have. You will find that you can do your work more easily, more quickly, more cheaply, and more efficiently.

Normally we do not like to use our editorial page to talk about ourselves. But when we are introducing so many improvements, we think it an opportune time to comment on our long-established editorial policy. We are not going to make any change here. A policy based on "always serving you" can never grow old.



Outlook for Fuels: Prices Going Higher

• Fuel costs are beginning to vie now with payrolls for the No. 2 spot on the list of operating expenses. And there's no relief in sight: Another coal price hike is likely this year

• Gas prices will jump, too. It's costlier to find and develop new sources these days. Gas, however, may regain some lost ground in '57. But oil's popularity will fade as its price climbs fast

In the next year, electric utilities will burn more coal and gas, but will cut back on oil. Although supplies of all three fuels are adequate at the moment, prices for all three will climb in the months ahead. The price of fuel oil will jump the most because production of Bunker C has been caught up in the Mid-East crisis.

Any increase in fuel cost takes on added significance because expenditures for fuel take the third-biggest hunk out of the electric utility's revenue dollar. In 1956, utilities spent 16.4¢ of each revenue dollar for fuel. Only taxes (23.8¢) and payrolls (17.7¢) claimed bigger parts of the operating income.

Despite the possibility of increased coal shipments to Europe, the supply outlook for the U. S. is excellent. Utilities won't run into any trouble in getting coal unless "crash" supplies are needed unexpectedly. The railroads, in this case, would become the weakest link in the chain of supply. There is a shortage of hopper cars. Mines could not ship all the coal they could produce.

As of Oct. 31, however, utilities had enough coal stockpiled to carry them about 109 days. Moreover, bituminous coal reserves (estimated at 1.9 trillion tons) seem copious enough to carry the industry for decades.

Regarding natural gas, there is a chance that more may be available this year because of the Mid-East crisis. But a small pinch may develop in the supply of Bunker C.

Utilities traditionally have relied upon coal as the major fuel for steam plants. But for 1957, there are indications that several companies will use more natural gas, and that some companies now taking Bunker C will switch—where possible—to another fuel.

Total electric power consumption of coal in 1957 will run about 170 million tons, says the National Coal Association. This compares with an estimated 157 million tons in 1956.

Consumption of coal from 1954 to 1955 increased 19.9% while oil consumption increased only 9.9% and gas use dropped 1%. (Oil and gas here are figured in their coal equivalent, using 24.2 million Btu per ton of coal.)

Coal prices almost certainly will climb in 1957. They dropped steadily from 27.3¢ per million Btu in 1953 to 25.2¢ per million Btu in 1955 while prices for oil and gas, meanwhile, climbed.

But it should be remembered that until late 1955, the coal market was slack and coal producers tended to absorb increased costs of new wage agreements. This picture is changing today. Some wage increases were passed on in 1955, and even more were passed on in 1956. An index prepared by the Bureau of Labor Statistics shows a jump from

Utilities Will Use Record Coal and Gas in 1957 . . .

Year	Coal	Oil*	Gas*
		(Thousands of tons)	
1952	104,193	15,748	36,617
1953	113,017	19,117	40,297
1954	113,897	15,698	46,223
1955	136,587	17,257	45,760
1956	157,000E	17,000E	57,500E
1957	170,000E	16,750E	70,000E

. . . But Cutback on Oil Because of Price

Here are the costs (Cents per million Btu)			
1952	27.3	33.1	14.5
1953	27.3	32.3	16.7
1954	26.1	32.8	17.3
1955	25.2	33.2	18.0
1956	26.0E	33.6E	18.7E
1957	26.8E	34.0E	19.2E

* Oil and gas are expressed above in coal equivalent, ie, thousands of tons on the basis of 24.2 million Btu per ton of coal.
E—Estimated by Electrical World

99.7 to 106.3 in September of 1955, another big jump to 110.7 in April of 1956, and a third to 119.9 in October of 1956. The new wage agreement calls for another pay boost in April, 1957, and coal prices likely will jump again.

Also in the immediate offing is the possibility of a 7% freight-rate increase (applied for by all major railroads except Chesapeake & Ohio) which carries with it a 10¢/ton increase for coal. An Interstate Commerce Commission decision is expected soon. Following hot on the heels of this freight increase is another one which some Eastern and Western lines already are seeking. It would boost the rates an extra 15% and carry a 5¢/ton boost for coal, exclusive of exports.

On top of this, coal exports represent a substantial prop for higher prices. Exports more than doubled from 15.1 million tons in 1954 to 34 million in 1955. They hit around 50 million in '56, and will jump to 55 or 70 million in '57. Part of the increase for '57 can be traced directly to the Suez-induced oil shortage in Europe.

Utilities to Use More Gas

Although the use of coal for electric power generation has been growing more rapidly than gas recently, there are signs that utilities will use more gas in 1957.

Southern California Edison Co recently signed two contracts calling for a total of about $500 million of gas in the next 20 years. Southwestern utilities, cradled in the gas fields, will increase gas use with growing load. An Oklahoma utility has completed a 40-mile pipeline from an independent producer to a major plant. And under a plan now pending at the Federal Power Commission, Florida Public Utilities and Florida Power & Light Co would purchase gas brought in by Houston Oil & Gas Corp, and Coastal Transmission Corp. Observers feel that, unlike other similar proposals, this program will be approved, and the pipeline may be working by the end of '57.

However, the gas gain will be tempered somewhat by Northern states where utilities are tapering off their consumption of gas by storing "dump" quantities underground—principally in Pennsylvania.

The outlook for gas supply reveals some expansion plans. But a $1.6-billion expansion planned for 1956 ended up as a $1.5 billion expansion because of a steel-pipe shortage. Increased labor and construction costs, plus higher expenses in finding new sources of supply, will continue to push up slowly prices of the fuel at the well.

A more nebulous influence on gas prices may be a new gas bill similar to the one President Eisenhower vetoed last year. Washington observers feel a similar bill will be introduced this year. It may reduce jurisdiction of the Federal Power Commission over independent producers. Last year, opponents of the bill said gas prices would skyrocket because of an "almost total absence" of regulation. Proponents, however, said gas prices would be less than otherwise because the bill would encourage new gas supplies.

Increased oil output may make more natural gas available in 1957 than anticipated because of the Mid-East crisis. Conservation laws prohibit flaring gas if it can be piped to the nation's burners. The American Gas Association believes some of this gas will be available by the end of the year, even though some petroleum producers return gas underground to speed oil production.

Oil Price to Jump 10%

Utilities probably will cut oil consumption in 1957—especially if prices go up 10% as expected. The Mid-East crisis is having a tremendous impact on petroleum producers, and there is a current "glut" of gasoline on the U. S. market. All those factors figure into the anticipated price rise for Bunker C.

For instance, the U. S. imported about 350 million barrels a day from Europe before the Suez crisis. Now the U. S. is sending 500 million barrels a day to Europe above normal exports. This means that U. S. fields are now producing 850 million barrels a day more than before the crisis.

In addition to Europe's domestic demand for crude, tankers are requiring twice as much fuel to haul crude around South Africa, and more tankers are working now.

At home, the petroleum industry finds itself with a surplus of gasoline and a heavy export demand for the "middle-grade" products. Increased prices for these middle-grade products are needed to justify distilling crude oil in proportions adjusted to the new demands.

Prices are expected to jump about 25¢ a barrel, therefore, even though supplies are "adequate." However, even the availability of Bunker C is not a certainty. A cold winter will tighten the supply. A mild winter may create a surplus.

But all-in-all, no serious situation should develop in the fuel picture in the next year for electric utilities.

WASHINGTON WIRE

REA Discloses Gains in Electric Co-op Growth

Rural electric systems in 1956 pushed operating revenues to a new high of over $500 million, Rural Electrification Administration reported in a year-end statement. Net margins for the systems, after deducting expenses, depreciation, and interest, rose 25% from 1955 to $73.3 million.

REA Administrator David A. Hamil attributed electric co-ops' growth to increasing attention to sales promotion and management practices, together with an influx of non-farm residents and small industries moving from crowded cities.

Average monthly consumption of all residential consumers, including farm users, rose 12% from 1955 to 269 kwhr. At same time power costs dropped 4% from 2.98 cents per kwhr to 2.88 cents.

REA-financed systems sold an estimated 22 billion kwhr, almost 15% more than in 1955. REA borrowers generated 3.6 billion kwhr (11% increase) and purchased 21.1 billion kwhr (14% increase) from other power suppliers during year.

Loans approved during year by REA totaled $229 million compared with $180 million in 1955. Of the total, $77.6 million was allocated to electrical generation and transmission facilities.

WASHINGTON COMMENT

PRDC Battle to Be Legal Bout; AEC's 'Referee' Post Disputed

The Power Reactor Development Corp hearing scheduled to start this week before an Atomic Energy Commission hearing examiner begins to shape up as a battle of lawyers rather than nuclear engineers or experts.

At issue is a construction permit granted by AEC to the Detroit group last August for a nuclear power project at Monroe, Mich., near Detroit. Three labor unions—the united auto workers, paper workers, and electrical workers (IUE)—have intervened in the matter on grounds that the project will be hazardous to the public at the chosen site. The hearing—first of its kind—becomes a real precedent-setter.

The weeks preceding this hearing have been marked by complex legal sparring between the unions and AEC with a constant flow of motions, memoranda, and orders on various legal points.

Most significant of the many points covered in this sparring has been the determination of the unions to prevent AEC from avoiding responsibility for what they consider an illegal act in issuing a construction permit. For its part, AEC has been equally determined to step aside from this issue and leave the fight between the unions and PRDC.

It appears that the most obvious way for AEC to avoid being tagged for an allegedly illegal act is for it to suspend the construction permit. By so doing, the issue of illegality would never be tested.

What has happened is this: The unions charge that in framing the issues for the examiner, the AEC has disregarded what is the heart of the union complaint, namely, that it acted contrary to law in issuing the construction permit in the first place. AEC responds to this allegation by declaring that the matter of the construction permit is not complete and PRDC must demonstrate that it is able to satisfy those "requirements of law and the commission's regulations which are in controversy," after which AEC will decide whether the permit should be altered, stopped, or continued.

The unions contend this ignores the fact that the permit already has been issued in violation of the regulations. "The commission cannot properly refuse to consider this matter now, nor excuse its failure to do so by the procedural device of declaring the proceeding still in progress and by ignoring an illegal determination previously made," they say.

This is where the matter stands now, although the unions plan to pursue it in the course of the hearings. They are not willing, they say, to let AEC stand aside as a referee. At the same time, they have every intention of taking the matter to court if they do not get satisfaction.

The paradox in the picture is that the unions' case can be satisfied for what they describe as the "wrong reasons." What this means is that if AEC succeeds in standing aside as a "referee" and either suspends the PRDC permit or makes satisfactory findings with respect to PRDC's financial qualifications and safety of its project, then the unions will not appeal the ruling.

The unions won a legal point in the pre-hearing sparring in retaining on the hearing agenda the question of financial ability of PRDC. The company had asked for this to be dismissed but AEC ruled against it. The commission said that PRDC's financial qualifications bear "a sufficiently direct relationship to the issues of safety as to entitle the interveners to be heard" on this matter.

Another issue has partly resolved itself. The unions had sought access to certain restricted data. The recent new tri-partite declassification guide announced by AEC will cover a good portion, if not all, of the documents the unions sought.

59 New Reactors Got "Go-Ahead" Last Year

In its progress report covering 1956, the Atomic Industrial Forum, Inc reports that the U. S. atomic industry last year began constructing or received contracts for construction of 59 new nuclear reactors.

Twenty-nine are power-type reactors. Fourteen will go into navy vessels, and six will be land-based power demonstration plants built for U. S. buyers other than the federal government. Four will be prototype or demonstration plants built for the U. S. Atomic Energy Commission, and four will be land-based plants for export. One is slated for propulsion of a merchant vessel.

The remaining 30 reactors will be for research and test purposes. Fourteen will be exported. The government will take nine, and private buyers in the U. S. will take seven.

Those reactors are in addition to the 17 projects already under way. These projects include 7 reactors or reactor prototypes for Navy ships, three power-type reactors for the government (including the 65-Mw Shippingport plant to be operated this year by Duquesne Light Co, Pittsburgh) four power reactors for non-federal buyers, two research reactors for AEC, and one for a university.

Moreover, during 1956 industry completed two reactors for Armour Research Foundation, Chicago, and Battelle Memorial Institute, Columbus, Ohio. This brings the number of completed reactors to 30. This includes the land-based prototypes of the Nautilus and Seawolf reactors, and the Nautilus' actual reactor.

The AIF points out, however, that the above figures do not include reactors built or being built by AEC laboratories. The figures cover only the activities of industry—whether for government, foreign, or private buyers.

Also during 1956, American industry signed contracts or announced plans to build eight uranium ore processing mills, a feed materials plant, five nuclear fuel element manufacturing plants, seven critical facilities, three zirconium, and two beryllium production facilities.

New power reactor contracts in '56 cover a 22-Mw plant for Rural Cooperative Power Assoc., Elk River, Minn.; a 10-Mw plant for Wolverine Electric Co-op, Hersey, Mich.; a 12.5-Mw plant for City of Piqua, Ohio; a 10-Mw plant for Chugach Electric Assoc., Anchorage, Alaska; and a 134-Mw plant for Yankee Atomic Electric Co, Rowe, Mass.

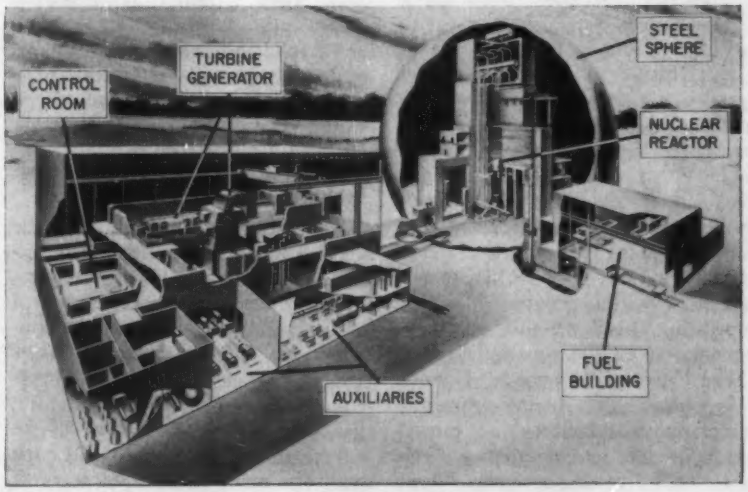
NUCLEAR NOTES

AEC's new "buy back" prices are $12 a gram for plutonium in the form of metal and $15 a gram for U-233 in the form of uranium nitrate. These prices take effect domestically July 1, 1962.

AEC announced no price change for natural uranium metal and heavy water (selling, respectively, at $40 a kg and $28 a pound). But prices are down for uranium fuel enriched to 20%. This costs $16.12 for each gram of U-235, a $9/gram reduction from prices set in 1955.

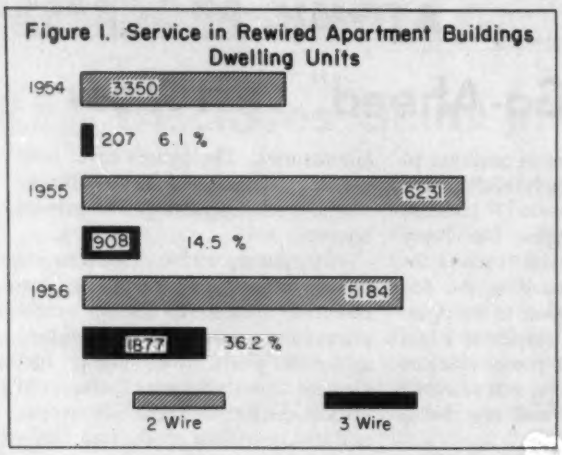
But AEC points out that "conditions of transfer" under new schedule differ from those prevailing under the "Geneva" price. The new schedule applies to uranium hexafluoride. The user must bear the cost of conversion to metal.

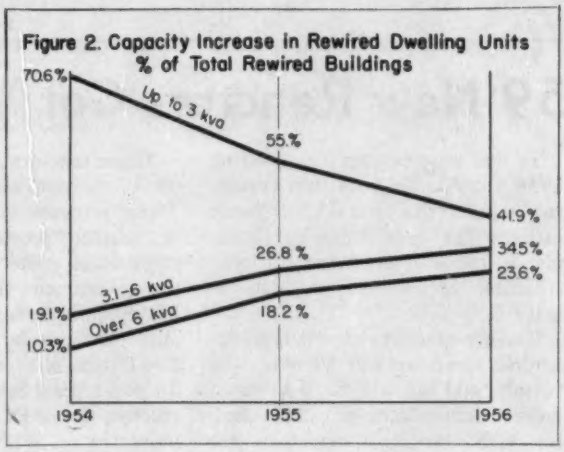
E. I. du Pont de Nemours & Co will undertake for AEC the design and development studies to learn feasibility of heavy-water-moderated reactors for power production, using natural uranium as fuel.



Work on Dresden to Start in Spring

With the approach of warm weather, construction gangs will get going on the $45-million Dresden station for Commonwealth Edison Co and Nuclear Power Group, Inc. To be situated on the Illinois waterway 50 mi southwest of Chicago, the 180-Mw boiling water reactor will be built by General Electric at a contract price of $45 million. Commonwealth Ed will pay $30 million plus site and overhead costs, and Nuclear Power Group will pay $15 million. By mid-1960, the plant should be completed. The reactor will be housed in a 190-ft-diam steel sphere. Fissioning uranium will boil water to produce steam for the turbine-generator.





Consolidated Edison Reports Progress

3-Year campaign boosts capacity both in new and existing buildings. Load growth, increased appliance use follow

C. **WESLEY MEYTROTT**, Assistant Vice President, Consolidated Edison Co of New York, N. Y.

Starting with a modest yield three years ago, Consolidated Edison Co's residential adequate wiring program today is snowballing into an avalanche of higher capacities and heavier wiring both for existing buildings and for new construction.

Records for the past three years, the period in which this formal adequate wiring program has been operating, back up this optimistic summation of the situation in New York City and Westchester County. They prove that higher capacities accelerate residential load growth and stimulate purchase and use of a wide variety of appliances and equipment.

These partially analyzed statistics indicate that Con Edison and the industry have been right in expecting the entire electrical industry and the general public to benefit from their mutual effort.

Prior to the program, extensive surveys of apartments and private homes revealed that four out of five were inadequately wired for existing needs; 9 of 10 for the one most wanted future appliance. To remedy these conditions in a city the size of New York required an approach that would appeal both to the general public and to specialists such as builders, architects, engineers, realtors, and financiers; above all, it would have to draw contractors into active participation.

Apartment Rewiring Soars

Furthermore it would not be enough to correct existing deficiencies. Unless Con Ed could promote widespread acceptance of higher wiring standards in new construction, today's new buildings might become tomorrow's inadequate wiring problems. Therefore, the program was planned to be effective across the board and cope with the many different aspects of the problem.

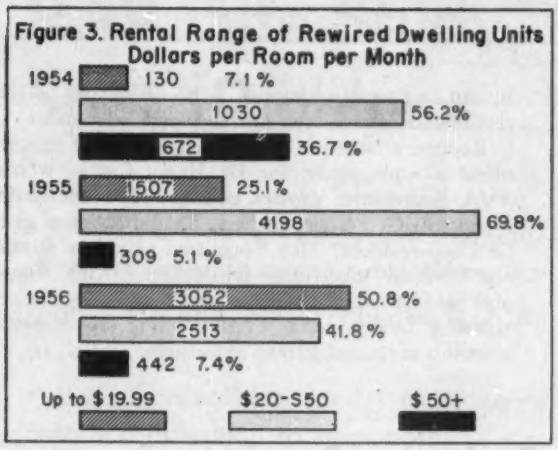
Evidence of the success of this program can be found in a number of encouraging trends. There has been a steady gain in the number of apartment buildings rewired in each of the past three years. Higher capacities and heavier wiring now are being provided in these rewiring jobs. Higher capacities are being built into new residential and commercial structures. More than ever before, the general public is aware of the importance of adequate wiring.

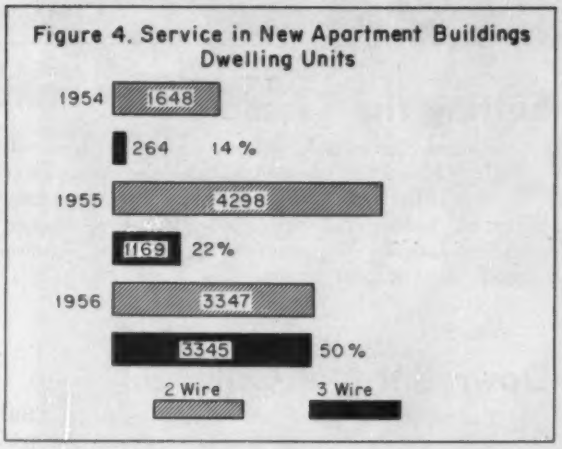
During 1954, the first full year of the program, 68 apartment buildings were rewired for higher capacities. The annual total moved up to 160 in 1955 and reached 174 during the first nine months of this year. This year's total is expected to be about 230. Based on the progressive gains registered each year, the aim is 500 rewired apartment buildings in 1957. The table below shows the number of buildings rewired thus far and the number of dwelling units these buildings represent.

	Buildings	Dwelling Units
1954	68	3,557
1955	160	7,365
1956 (to 9/28)	174	7,077
Total	**402**	**17,999**

This steady gain in number of buildings and dwelling units rewired has been accompanied by an equally steady trend toward higher capacities. In 1954 only 6.1% of dwelling units in rewired apartment buildings included 3-wire service. By 1955 this percentage had more than doubled. This year more than 36% have it. These gains are shown in Fig 1.

Rewiring obtained is tabulated by the increase in riser capacity over





in N. Y. Apartment Wiring Program

that existing before. Reinforcement of switches, mains, and distribution wiring alone is not counted. In 1954 capacity increases were 3 kva or less in 70.6% of the total buildings rewired. This year only 41.9% of the rewired buildings fell in this range. The percentage in which dwelling unit capacity increased by more than 3 kva has doubled in three years. In almost half of these, the capacity increases are more than 6 kva. These comparisons are illustrated in Fig 2.

Both the location and rental range of apartment buildings rewired to date in New York City prove that the rewiring market includes all rental ranges. Although the rewiring got off to a faster start in the more expensive apartments, the pendulum rapidly has swung the other way. As a result, the proportion of rewired units with rentals less than $20 per room has increased seven-fold since 1954. In the first nine months of this year, 50.8% of the rewired units fell in this category. These are low rentals in this area, and prove that rewiring is truly a mass market business. An analysis of rewired dwelling units by rental range of 1954, 1955, and the first nine months of 1956 is shown in Fig 3.

New apartment construction is every bit as encouraging. There has been a gratifying increase in the number of new buildings, in the blueprint or early construction stages, whose capacity levels have been increased as the result of Con Ed's promotional efforts. In 1954, a total of 1912 apartments were affected. This figure rose to 5467 in 1955 and to 6692 in 1956. These figures, of course, do not include buildings in which wiring specifications were upgraded without the Adequate Wiring Bureau people being drawn into the picture. Wherever the originally contemplated wiring was made heavier, the average riser capacity per dwelling unit has moved steadily upward from 5.4 kva in 1954 to 6.3 kva in 1955 and 7 kva in 1956.

3-Wire Service Increasing

Another measure of new building capacity is the number of dwelling units with 3-wire service. In 1954, 3-wire service was provided to only 14% of new dwelling units. Today this figure is 50% and still moving upward. In 144 apartment buildings now under construction, 54% of the dwelling units have 3-wire service. For apartment dwellers, the most numerous type of residential customers, this is a major breakthrough. Fig 4 shows the trend from 2-wire to 3-wire supply in new buildings over the past three years.

These years also have brought a steady improvement in capacities of new private single family homes. In 1952, the year before this adequate wiring program, was launched, 70% of the new homes in New York City and 32% in Westchester County were provided with 2-wire service.

By 1954, 2-wire service was well on the way out, and 3-wire service was being supplied in 83% of new private homes in Con Edison's service area. Now, all new homes here have 3-wire service and commensurately heavier and more numerous branch circuits.

Public awareness of the significance of adequate wiring has developed favorably since this program got under way. It has become increasing evident that the adequate wiring message, as well as that of other branches of the industry, has been getting across to Con Edison customers.

For example, requests from apartment building owners for adequate wiring studies are up 33% in the past 12 months compared to 1955. Recently they have averaged more than 150 a month, up 74% since 1954.

By the same token, more private home owners are requesting adequate wiring surveys. More important they are accepting the company's recommendations and having the work done. Last year, 65.5% accepted these recommendations. So far in 1956, the acceptance rate is up to 76%.

Setting the Example

Eastern Shore Public Service Co of Maryland will build a $2-million service and administration center near Salisbury "in the near future," the company reports. Indoor office temperature will be maintained thermostatically at a comfortable level by 25 automatic electric heat pumps.

Down But Not Out

Failure of Congress last session to pass a bill enabling the federal government to build a single high dam at Hells Canyon may have knocked proponents of this plan off their feet. But this legislative blow was not a fight-ending knockout.

Now Oregon opponents of Idaho Power Co's Hells Canyon project have regained their footing and resumed the fight. This time they have asked the state's new water resources board to hold hearings on the proposal. This board, created in 1955, has the power to reject or to require modifications in a dam permit if the dam would be "detrimental to the public interest." This is the first time the board has been asked to hold such a hearing.

The request was made by attorneys acting in behalf of Oregon State Grange, Oregon State Labor Council AFL-CIO, Oregon Farmers Union, Oregon REA Co-operative Assoc, and Hells Canyon Development Assoc—all of which favor a single high federal dam in Hells Canyon.

F-80 Cuts 12-Kv Line

Maj Willard M. Worley gunned the engine in his sleek F-80 and roared across Hensley Field for a jet takeoff. Trailing behind was a target plane which servicemen would shoot at with "camera guns" to practice marksmanship. But the target plane broke free upon takeoff.

As Maj Worley circled for a landing, the dangling towline whipped into and severed a 12-kv Texas Electric Service Co power line, disrupting service to about 1,000 customers in the Grand Prairie area. Line crews restored service about 2 hr 42 min later. No one was hurt in the accident.

Vogel on TVA:

"It is my purpose, and I know it to be the President's purpose, to strengthen the Tennessee Valley Authority as it relates to the Tennessee Valley," said Brig Gen Herbert Vogel, TVA chairman, in a speech delivered at the Civitan Club in Chattanooga. "If I have been unable in the two years I have been in the valley to convince my critics that my aim is to make the authority more sufficient, to strengthen it, and to have it respected in the valley and by the rest of the nation, then I have failed," he said.

Reporters closed in for details. Would he recommend a replacement for Dr Harry Curtis, whose TVA Board term expires in May? Not unless it's asked for, Gen Vogel replied. Should the new man be a non-resident? Gen Vogel said residence should not have an "overriding importance." Gen Vogel also said he hoped Congress would enact legislation enabling TVA to issue revenue bonds. He foresees intensive industrial growth in the area.

Deductive Reasoning?

Purdue University engineering students have been comparing help-wanted ads in electric utility magazines with those in electronics magazines. They have been drawing conclusions regularly that more opportunities await them in the field of electronics, than in power system engineering, says a Purdue professor.

To Save Lives . . .

Pittsburgh's Coroner William D. McClelland has urged construction companies to be particularly careful in locating gas mains and power lines before starting excavating and pile-driving operations. He made the recommendation after a 55-year-old Equitable Gas Co employee was accidentally asphyxiated in a manhole about five hours after a pile driver punctured a 20-in. gas main. Testimony at the inquest revealed that the main's location was not clearly shown on old records prepared by the state. The main actually lay about five feet from the spot shown on the plan.

Now Clicking Away . . .

As EW went to press, 20-year-old Nancy Dyer for two days had been thumbing through Union Electric Co's stockholder records while an assistant microfilmed names and addresses. Her avowed purpose is to solicit proxies to obtain a new board of directors to replace the company's present management. (EW, Dec. 31, p 15.)

A suit, filed in her behalf by her attorney father J. Raymond Dyer, was thrown out of court. Circuit Court Judge Waldo C. Mayfield ruled that Attorney Dyer had no right to the stockholder lists—which he sought as a representative of Nancy who holds 100 common shares. Judge Mayfield denied Dyer's petition with prejudice.

Union Electric granted Miss Dyer permission to see the stockholder records, but would not prepare a list for her or give her the use of its address plates.

R/W, Site Study Spots Problems

Electrical World survey shows:

- **Utilities are hampered by cost and scarcity of transmission routes, substation space**
- **66% see EHV, aerial cable and/or UG as alleviation of problem**
- **More than half buy land 1 to 20 years before construction to beat cost**

R/W AGENTS discuss route with farmer. Van G. Berkley (center) and V. M. Stewart (rt) represent Pennsylvania Electric

The high cost of rights-of-way and sites and the mounting difficulties of obtaining them are main concerns today of electric utilities. And the varied problems of getting and keeping space are getting tougher.

These are conclusions gained from a recent Electrical World survey (see pages 51-53). The tone of 84 replies from companies, municipal systems, and government agencies indicates their growing concern.

Here's what the survey revealed, including some steps taken or planned to meet the challenge:

Transmission R/W are giving utilities the most trouble. It was listed by 66 of them as one of today's main challenges. Suburban R/W was mentioned 14 times; potential home developments, 11. Nine utilities said rural areas are troublesome. Commercial and/or industrial R/W pose problems for seven.

To keep a jump ahead of spiraling property values, 56% are acquiring R/W, sites, or both, in advance of construction. A dozen companies qualified their answers, though, by adding "sometimes, infrequently," or citing a specific case.

The "buy-ahead" time averages about 3½ yr. Management purchasing policy ranges from 1-yr max to 10, 15, and in one case, 20 yr.

Varying views on when property should be included in the rate base were revealed by a separate survey of state regulatory commissions (see box, page 48). Of 35 replies eight said site or R/W costs may be included prior to completion of construction. Nine commissions reported that it depends on individual circumstances or hinges on other requirements; 18 said costs are not included beforehand.

Only three states limit time between acquisition of land and actual use, according to the 35 replies. In Louisiana construction must begin in the "foreseeable future." On original cost audits in Michigan, land is classed in Account 100.4 (plant held for future use) when it is to be used within five years. Ohio utilities are limited to the construction period.

Several utilities said they faced construction deadlines when property is condemned. In Wisconsin, however, legislative changes (Nov. 7, 1955, p 15) have provided precedents which have prompted utilities in other states to cast out feelers.

A more flexible Wisconsin statute amendment passed in late 1955, a change in the easement abandonment law permitting long-term expansion programs that will pay off in substantial savings.

Statute Is Eased

Previously, the statute interpretation usually required early start of construction after project authorization. The abandonment law sometimes left utilities dispossessed when they didn't start building shortly after acquisition.

The changes protect "our power plant sites from being bottled up or from paying the extravagant costs of buying our way through costly real estate developments ten or more years hence, or putting in an unwarranted amount of underground service at greatly increased costs," said G. W. Van Derzee, Wisconsin Electric Power Co board chairman.

One of the best, most widely used transmission R/W tools in planning is aerial photography. Virtually all utilities use it. Besides affording quick, up-to-date mapping, aerial photography provides at least preliminary R/W planning without the knowledge of the property owner.

"Approximately 90% of transmission easements are acquired from aerial photos before the survey," said the vice president of a company in the South. The engineering manager of a Southwestern company said, "We've cut our surveying and staking time by 50% through use of aerial photos."

"We've been using them for 30 yrs," replied a third company. In the West one utility finds helicopters ideal for locating access roads, and determining types of soil, and tree or underbrush density and size.

"Our entire territory—7,600 sq miles—has been aerial mapped," said Richard H. Taylor, director of Detroit Edison Co's real estate and right-of-way department.

Geological survey maps blown up to large scale are used in a method that's helping NEGEA System Corp, Cambridge, Mass. With the enlargements the utility determines

likely road crossings and streets on which it can concentrate its efforts.

"This shows us where we can go through," said NEGEA's Pres R. D. Stauffer. Studying these and other maps, then following up with a helicopter, "gives us about a 40% saving in engineering costs over the rag line survey method we used to use." Previously, three or four surveys were usually needed, Stauffer said. Though one or two corners may result from the map method, "it's cheaper in the long run."

Condemnations are a last resort for practically all the surveyed utilities. Here are a few of their replies to the question, "What measures are taken before deciding to start condemnation proceedings?"

- Extraordinary effort made to reach reasonable, fair agreement.
- All reasonable steps are taken . . . studies are made (for a) reasonable alternate, then management and board approvals are required.
- Obtain management, local division, and public relations approval.
- Try to acquire by use of public appraiser and up to an amount of estimated condemnation cost.
- Extensive negotiations and increase of base payment.

As to condemnation awards and settlements, 60 utilities (71%) stated they are experiencing fair or favorable treatment, observed no noticeable trend, or had had no recent cases. Several said they'd never used eminent domain proceedings. Five said awards varied or were going 50-50. Seventeen replies revealed awards were running above appraisals.

One superintendent of electric operations put it this way: "An average of the awards . . . show that they exceed our appraisals by 30%. But, on the other hand, they average about 70% below property owners' appraisals."

A Rocky Mountain company's land agent related this incident: "The jury award in one proceeding was so excessive, the judge, by lawful procedure, reduced the amount by approximately one half. The adjusted award was three times the amount determined by independent appraisers."

Zoning Laws Hamper

Costs, lack of space, and neighborhood disdain are only a few of the puzzlers hampering substation site procurement. Forty-two mentions were returned on this problem, 11 pinpointing residential areas, eight urban and five suburban. Presumably the remaining 18 face substation trouble throughout their service areas.

One aspect of the substation dilemma came to light in Missouri where, as in many states, laws provide for municipal zoning. Local boards are supposed to zone in public utilities. More often than not, though, the buck is passed to zoning adjustment boards. The adjustment men, in turn, have to veto utility access as zoning plans have already slammed the door.

To help clear this hurdle, Union Electric Co publishes a brochure

How State Commissions View Property in Rate Base

Is cost for sites or R/W included in the rate base before completion of construction or placing property in commercial operation?

Ala. . . . .**Yes**—Allowed as Account 100.4 (property held for future use), when definite plan is shown, usually with 3-4 yr limit.
Ariz. . . .**No.**
Calif. . . .**Yes**—With future use plan and not taking construction interest thereon.
Colo. . . .**Yes**—Must show evidence in hearing on use in near future.
Conn. . .**No.**
D. C. . . . .**Yes**—With definite plan; includes "construction work in progress" in lieu of accruing and capitalizing "interest during construction."
Fla. . . . .**No.**
Ga. . . . . —Usually, when classed Account 100.4; after construction starts transferred account may or may not be included depending on accounting.
Idaho . .**No.**
Ill. . . . . .Generally not for work in progress; depends on amount of completion.
Ind. . . . .**No.**
Ky. . . . .**No.**
La. . . . . .**No.**
Maine . .**No.**
Md. . . . . .Depends on circumstances (Case No. 5176, Mar. 11, 1952).
Mich. . . . . .Have used capitalization rate base in recent orders.
Mo. . . . .**No.**
Nev. . . .**No.**
N. H. . . .**No.**
N. J. . . . . .Depends on circumstances.
N. M. . . .**Yes**—Original cost usually included after construction starts.
N. Y. . . . . .Varies according to circumstances.
No. C. . . . . .Excluded when interest on investment has been capitalized, included sometimes when not capitalized.
No. D. . . . . .Probably, if held under a definite plan.
Ohio . . .**No.**
Pa. . . . .**No.**
R. I. . . . .**No.**
S. C. . . .**Yes.**
Tenn. . . .**No.**
Utah . . .**Yes** -Depending on circumstances.
Vt. . . . . .**No.**
Wash. . .**No.**
W. Va. . . . . .Average amount for Account 100.4's, not construction work in progress.
Wis. . . .**No.**
Wyo. . . .**Yes**—If property becomes part of plant in forseeable future.

Where Does the Highway Bill Lead?

"It would be my guess that 60 to 70% of (electric utilities) will be affected to some degree by the improvement of the federal aid primary or secondary systems."

Clyde K. Wallace, general land and title supervisor of Consumers Power Co, made this estimate last summer after a cross-section sampling of electric utility opinions on what impact the highway act would have.

The degree to which they'll be affected, he said, depends on varied factors, four of which are:

1. Utility size—plant and service area.
2. Ability to absorb the shock.
3. Geographic location.
4. Policy on location of facilities in public R/W.

For utilities with widespread systems, relocations probably won't be serious, Wallace said. Those with concentrated facilities in the path of major federal highway projects face a tremendous job, especially with limited access roads.

State highway activity in 1957 is expected to center on project building plans for Bureau of Public Roads approval. They have to solve problems on final location of interstate mileage, how commercial facilities are to be handled, whether to pay utilities for relocations, and, if so, how much.

Who foots the bill? The act says relocation reimbursements by the state may be taken from federal funds, providing this is legal in the state. According to Attorney Francis Hill, the legality of relocation payments is still uncertain in 43 states. Hill, representing privately-owned Oregon utilities, told the state's highway commission an effort would be made in the legislature to legalize reimbursement.

National Highway Users Conference, Inc, had this to say about the state picture:

- New York, Wisconsin, and Hawaii have statutory provisions on reimbursement for relocations on state highways which relieve utilities, either wholly or in part.
- California, Connecticut, New Jersey, and Wisconsin have specific provisions in state expressway laws requiring the state to pay all or part of relocation costs.
- Laws in 18 states* require toll road authorities to pay the costs or, if the highway departments build the roads, they pay.

NHUC has nearly finished compiling results of a U. S. poll to get state feelings on reimbursement.

In California the highway division paid almost $11 million to utilities, cities, and counties in the last fiscal year. For utilities the tab was $7.5 million. "By 1962-63 the total cost of relocation of . . . utility facilities could be $40 million a year" in California, said Frank C. Balfour, head of American Right of Way Association.

An admittedly rough guess by NHUC sets relocation costs for all utilities during the next five years at $1.5 billion. This and long-range costs are less than some original estimates because over two-thirds of coming interstate mileage is slated to go on new locations which generally leave utilities undisturbed.

With the highway program "we right of way people will be faced with the same old problems, except there will be more of them and less time alloted for their solution," said Consumers Power's Clyde Wallace.

* Alabama, Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, New Jersey, New York, North Carolina, Ohio, Rhode Island, Texas, Virginia, and Wisconsin.

describing proposed installations. Designed for members of zoning boards, city councils, community groups, and other interested parties, it consists of about 20 pages of artist sketches, photos, and typed copy. The text details safety features, landscaping, and neighborhood necessity. Company men distribute the brochure in person and stand by to answer questions.

Said Union Electric Vice Pres and Chief Engineer E. L. Hough, "If people know the facts, they'll usually cooperate. We've found the brochure an effective, inexpensive means of telling our story." Besides dispelling fears and calming TV and radio reception worries, the firm scores on another good-will front by having local garden clubs help on landscaping.

The snags of zoning board dealings and local ordinance hindrances got frequent mention in answers to a survey question asking for a breakdown of today's problems by downtown, residential, suburban, and rural areas (answers not included in table). As an Eastern company's vice president said, "More and more communities have adopted zoning and planning ordinances that make it obligatory to get permission from municipal bodies before even the purchase of a substation site.

"Towns and even rural sections are enacting zoning ordinances," remarked the president of another Eastern utility serving small towns and farmers. "County and district zoning boards are more vigilant," observed a Midwest manager of engineering. "This tends to increase difficulties in obtaining substation sites and right of way."

It isn't altogether gloomy, though. "Work with zoning bodies is limited as the (state) commission can grant variance from zoning ordinances," said a vice president and general counsel in another Eastern state. And in the area served by one West Coast company, "Zoning and land-use ordinances seem to be improving," said the chief engineer.

Having a company representative on the city planning commission helps, suggests a Midwest company.

If a North Central company's plans are successful, the state in which it operates may eventually adopt uniform municipal zoning requirements and establish a zoning and planning review authority.

The question on downtown, residential, suburban, and rural problems brought out the bugaboo of congestion. Congested areas and the problems of relocation caused by them were listed 70 times. And almost half are downtown.

Of the 56 utilities describing problem-solving changes, much of the work or planning aims at clearing congestion. Their efforts hinge mainly on extra-high voltage, underground and aerial cable and ap-

plication ranges from "as a last resort" to extensive use. Nine mentioned interest in or installations of higher distribution voltages. Other solutions include double-circuit towers and UG residential service, on which a Rocky Mountain company is conducting research.

As to price offer policies, 29 repliers said they were standard. Usually, they added, "depending on land values, appraisals" or other factors. Twenty-five offer amounts based on distance, acreage, poles, guys, or structures. Twenty-seven said either no standard price is offered, or that policy is flexible.

Give Price Bases

"The price we pay is our appraisal of what is fair value, including severance damages," an operations and construction superintendent of a Pacific Northwest company explained. "We have a firm rule of establishing prices in advance for various conditions and do not deviate from this pattern. We find that one of the major secrets in obtaining right of way is treating all customers alike."

Criteria for payment in a large Eastern company is based on a "realistic approach," an assistant secretary said, in which price offer is weighed against alternate parcels, going prices for adjacent land, costs of dickering delays, and customer relations. He estimated that land costs have doubled in 10 yr.

Severance is included in the offers of 57 utilities. Five others provide it sometimes; 11 do not.

It's a definite advantage to have real estate agents handle actual purchases, an old-timer with an East Coast company said. Over half the deals are made by agents working under the firm's supervision. Prospective sellers are informed of the utility's connection except in isolated instances, he said.

Forty-four percent of the answerers use agents and contractors. The majority, though, rely on them only occasionally.

Where do you find and how do you train R/W men?

"You can't hire good, experienced R/W men. You hire men whom you feel have possibilities and then try to educate them in this field."

This view of Richard Taylor, Detroit Edison Co, sums up many answers to the question above, except it would be changed to read "You transfer or hire men." Taylor and his associates are currently working with Michigan State University to develop training courses for "this specialized field of selling" in which R/W men must close a deal with everyone contacted.

Also working for a comprehensive college-level program is the American Right-of-Way Association, a 22-yr old group which became national in scope in 1946. Frank C. Balfour, founder and present chairman, is chief R/W agent with the California Division of Highways.

With the impact of such R/W upheavals as the Federal Aid Highway Act "we're going to see right-of-way departments expanding overnight—to a far greater degree than ever before—particularly in the West and portions of the Midwest where departments are already faced with large expansion programs," Balfour said.

Need Special Training

Nearly all utilities obtain R/W department replacements by transfer from within. Atlantic City Electric Co described a setup typifying many described in replies. A new man is almost always transferred from another department and is eligible for standard in-service training offered by the company. He begins with an experienced man on what are expected to be routine distribution extensions. This is supplemented by office work on easements, plotting jobs, and mapping. When he is familiar with procedure and policy, the beginner accompanies a veteran in pursuit of transmission R/W.

"It's usually about a year before he goes out on his own," said Atlantic City Electric's Charles D. Conover, superintendent, real estate. (This ranges from a month to a year with other utilities.) As for requirements: "He has to know and be able to meet people. And if he comes with line or engineering experience, it is all the better."

EEI Group Urged

For a federal agency "personnel is recruited through regular civil service procedures, and agricultural or forest backgrounds are required," the administrator said. They get intensive training, "including both practical field work with an experienced employee and theoretical training in appraisal procedures."

Beginners with a Midwest company must acquire 44 college credits in their first year and 88 credits during the second to gain promotion eligibility. Another utility hires law school graduates.

This trend to increased R/W training and education may be a partial answer to problems that plant expansions, highway building, and population growth are bringing to electric utilities. Technological gains in aerial and underground cable and EHV will certainly help. Still another advance may come as utility education programs help clear a path through the local zoning ordinance wilderness. State legislation, permitting long-range easement and site acquisitions, seems long overdue.

One way to speed progress would be the formation of an Edison Electric Institute committee, according to at least one real estate director. A pooling of R/W know-how and resources would aid personnel recruitment and training, provide some taking-off points on the route to needed local and state legislative changes, and keep R/W men informed of current trends.

With today's high-riding management interest, as expressed in EW's survey replies, a national collaboration of electric utility men might be next on the busy R/W agenda.

Shades of Old Battlegrounds

Wild West days are not so long gone that they are forgotten. Right-of-way maps for Pacific Power & Light Co's Caspar to Yellowstone, Wyo., transmission line are a reminder. The line passes over rugged regions that were once battle-grounds for Crow and Sioux warriors who harassed the white man's encroachment on buffalo hunting domains. Easement names include Agnes Smart Enemy, Little Antelope, Sara Bullchief, Sebastian Long Bear, Crooked Face Nest, Yellow Mule, and Dirty Foot. They're all descendants of warriors who, with Sitting Bull, Crazy Horse and Red Cloud, rode against Custer.

Electrical World's Survey on Right-of-Way Practices

Utility	Yr R/W, sites secured in advance	General R/W, site problems	Recent problem-solving changes, plans	Standard pricing policy	Severance damages in price offer	Dept. R/W men report to	Use agents, contractors	Condemnation awards
1	5–10+	Suburb transm R/W	No	Per acre	Sometimes	Engg	No	Majority above offer
2	2	Subs, HV R/W	No	No	Sometimes	Transm & Dist	No	None
3	1 max	Occasional "rough" owner	Aerial cable dist	Per structure or guy	No	Land & Tax	No	None since '49
4	None	Urban density	No	When necessary	Yes	Engg	When advantageous	Fair
5	2	Subs	No	Yes	Yes	Property mgmt	Appraisals	90% settle before court action
6	1–5	Res suburb R/W	UG dist feeders, landscaping	Yes	Yes	Real Estate & Tax	Agents	High register of value judgment
7	Major 5 Other 2	Urban sites; res, indus R/W	No	Per acre	No	Real Estate & Claims	Agents	Favorable
8	1–2	——	No	Per acre	No	Engg	No	None
9	1–6	Indus, commercial transm R/W	Studying EHV, UG, aerial cable	Usually	No	Lands & R/W	Yes	Frequently above fair market
10	3 or more	Transm	UG dist sub getaways	No, varies	Yes	R/W & Land	Contractors	Most settle before court action
11	1–5	115-kv subs, transm R/W	Congested area UG	Per acre	Yes	Engg	No	Fair, just
12	to 5	EHV over potential subdivision	No	Yes, established for conditions	Yes	Engg	Agents rarely	Fair
13	None	"Suburb view" lots, EHV R/W on farms	No	Per structure, guy	——	Operations, Property	No	Favorable
14	None	Suburbs	No	Yes	Yes	Land, Legal	No	Varied
15	2–4	Res transm; "luxury" area pole lines, commercial dist stations	Station spacing; length, feeder voltage, UG studied	Based on fair market value, appraisals	Yes, if any	Land	No	Satisfactory
16	None	Rural areas evolving to suburb, indus	EHV	Per ft or mile	Yes	Engg	Some	Very well
17	1	Subs	——	Yes	Yes	Land	Yes	None
18	None	Urban transm R/W	Some aerial cable, UG (2.4 & 13 kv)	No	Yes	Engg	Appraisers	Few
19	None	Res, suburbs, timber lands	Some aerial cable, 1 UG network, HV dist	No	Yes	Engg	No, special cases only	Very reasonable
20	1–2	Subs, urban R/W	Some aerial cable	Per acre of use	Yes	Real Estate	Agents	Midway between offer, owner demands
21	None	Growth areas, govt-owned land	No	Yes	Yes	District Transm & Dist	No	No problem
22	2–3	23-kv pole lines	Aerial cable, UG, EHV if other means fail	Per ft on acreage basis	Yes	Design	No	Most very fair
23	None	Res subs, farm transm R/W	Dist sub getaways changed	Usually	Yes, if any	Operating	Yes, for sub sites	None in 30 yr
24	Occasionally	Suburbs—potential developments	Converting to 23-kv wye	Depending on local values	Yes	Engg	Some agents	No trend
25	None	Street, highway crossings	HV planned along highways	No	Yes, if any	——	Seldom	Cases pending
26	5–10	Potential home developments	Aerial cable, UG, EHV if feasible	No	Yes	Property & Transm	Limited extent	Fair to both
27	None	Potential subdivision, urban areas; timber lands	Single pole wishbone construction	Yes, for most initial offers; scale varies	Yes	Secretarial	Agents rarely	None recently
28	None	Pole lines	No	No	Yes	Engg	Agents	Seem fair
29	None	Transm	No	Based on appraisal	Yes	Construction R/W Section	R/W contractors	Very reasonable
30	1–3	Res subs	Aerial cable, HV	Yes, for rural	Yes	Real Estate	Sparingly	Most judgments fair
31	None	Rural transm R/W	Platform subs; aerial cable, UG	If possible	Separate	Engg	Some agents	No trend
32	None	Suburb multiple-pole tower transm	Bundled conductor, twisted cable study	No	Yes	Engg & Real Estate	No	Equitable

Abbreviations: Co—Company; Corp—Corporation; Dist—Distribution; Engg—Engineering; EHV—Extra-high voltage; HV—High voltage; Indus—Industrial; Max—Maximum; Metro—Metropolitan; Mgr—Manager; OH—Overhead; Res—Residential; Sub—Substation; Transf—Transformer; Transm—Transmission; UG—Underground.

These Are Today's Right-of-Way Problems, Procedures,

Utility	Yr R/W, sites secured in advance	General R/W, site problems	Recent problem-solving changes, plans	Standard pricing policy	Severance damages in price offer	Dept. R/W men report to	Use agents, contractors	Condemnation awards
33	2–10	Suburb areas evolving to subdivisions	Aerial secondary, downtown UG, joint-use	Not standard	Yes	Deputy Director, Administration	Seldom	Limited; judgments unfavorable to govt bodies
34	None	Redeveloped commercial lines	Aerial secondary	Sometimes	Some	Engg	Some	Little experience
35	1–3	Suburb, res, developed farms	EHV, parallel lines, double circuit towers	Value reduction+damages	Yes	Land Section, Engg	No	Near appraisals
36	None	Subs, transm R/W	No	Yes	Yes	Legal	Yes	Damage awards excessive
37	None	Subs varying from zoning, transm R/W	No	Land values	Yes	Land Division, Engg	For sites	Tendency to soak corp
38	None	Res unit subs	Occasional advance agreement on construction	No	Yes	R/W & Property	No	Average fair market
39	None	Subs, transm R/W on private property	Studying UG	No	Yes	Executive	Rarely	Increasing but not out of line
40	None	Microwave tower, subs plattable area R/W	No	Per pole, structure	Yes	Operating	Agent appraisals	Rare, tending to go against
41	R/W—2 Sites—5	34.5-kv loop tap lines	Some aerial cable, UG; higher structures	Yes	Yes	Engg	Appraisals	Some jury decisions high. PUC orders in line
42	None	Subs	Enter, leave with UG	——	——	——	Agents	——
43	2–3	Recorded easements	Double-circuit towers	Per structure	Yes	Real Estate	Sometimes	None
44	None	Suburbs	Considering EHV; UG for downtown, dist aerial cable	Per acre, usually	Yes	Land	No	Juries tend to make max appraiser allowance
45	5–10	Transm R/W	Some aerial cable, 34-kv subtransm dist	In certain areas	——	Operating & Engg VP	Yes	No recent cases
46	None	Transm R/W	230-kv; 7-yr-old 110-kv downtown UG	Per acre	At times	Land	Some agents	Average fair value
47	None	Res subs, suburbs, cross-country easements	66-kv; 12.5-kv dist	Per rod, usually	Yes	Engg	Sometimes	Higher because of inflated prices
48	2–5	Suburb transm	No	Yes	Yes	Overhead Line	Some	Mostly fair
49	5–10	Depends on place	When R/W plus construction is excessive	Per acre	Yes	Engg	No	Varies; subject to court-appointed commissioners
50	2–5	Transm	Aerial cable, UG, EHV in special cases	Yes, to start	Yes	Real Estate	Yes	Expensive
51	1	Urban subs, transm R/W in suburbs	110-kv UG in urban, suburb	Per mile, usually	Yes	Real Estate	Contractors	Too few for comment
52	In special cases	Transm	No	Per mile	No	R/W & Real Estate	Agents	Price often too high
53	2	Res subs	No	Per mile	Yes	Engg	Agents	Not against co yet
54	None	Urban subs, farm R/W	No	Yes	No	Engg	Very little	About 50% against co
55	R/W—3–5 Sites—to 10	Super highway, res R/W; res subs	Some dist aerial cable, EHV planned	No	Yes	Engg & Construction, Work Order	Limited	Far above appraisers values
56	3–5	Transm, subs	Multiple circuit towers, UG as last resort	Generally	Yes	R/W	No	May be based on max price of adjacent land
57	3–5	Suburbs, near cities, indus	Metro UG vaults, aerial cable for tree problems	Per pole & anchor	Yes	Division mgrs, dist; Real Estate mgr	Some	Same or less than final offer

Abbreviations: Co—Company; Corp—Corporation; Dist—Distribution; Engg—Engineering; EHV—Extra-high voltage; HV—High voltage; Indus—Industrial; Max—Maximum; Metro—Metropolitan; Mgr—Manager; OH—Overhead; Res—Residential; Sub—Substation; Transf—Transformer; Transm—Transmission; UG—Underground.

Plans, and Progress of 84 U. S. Electric Utilities

Utility	Yr R/W, sites secured in advance	General R/W, site problems	Recent problem-solving changes, plans	Standard pricing policy	Severance damages in price offer	Dept. R/W men report to	Use agents, contractors	Condemnation awards
58	None	Cultivated field R/W; absentee owners	Plans to simplify R/W forms	Yes	No	Mgmt & Construction	No	Too few for trend
59	Depends on need	Plant, sub sites; housing development R/W	No	No	Yes	Real Estate	Some	Not going against co yet
60	None	69/12.5-kv subs; transm guying, overhang	UG 12.5-kv risers; aerial cable for future feeders	No	Yes	Engg	Yes	Fair
61	1–3	Suburb transm R/W, res subs	Some aerial cable, UG, EHV	No	Yes	Land	No	Usually higher, generally fair
62	None	Dry land wheat farms	No	Transm easement appraisal	Yes	Chief of Regional Land Acquisition	No	Unfavorable
63	1–5	Suburb sites, R/W	Aerial cable, UG, EHV	No	Yes	Real Estate	No	No recent cases
64	2	Metro, suburb sites, R/W	Plans sub changes	Rural areas	Yes	R/W	——	Prices higher but equitable
65	2–10	Transm R/W; res subs, regulators	Res UG research; removable roof housing for regulators, transf	Sometimes	Yes	Construction & Engg	Some	Not going against yet
66	1–2	Subs sites, transm R/W	No	Not fixed	——	General engineer	Some agents	No recent cases
67	None	Urban, suburb H-frame lines; res subs, irrigated rural R/W	Aerial cable, downtown UG feeders	Based on type land	——	Land VP, or division mgmt	Some agents	No pattern
68	5	Res sites, suburb R/W	345-kv transm; 50-mi of 120-kv UG lines (headquarter city)	$5 per 24–40-kv wood pole for perpetual easement	No	Mgr, Purchases & Real Estate	Yes	Above fair values
69	1–10	Suburb, subdivision transm easements, fee title	Considering 330-kv	Unit easement offer	Yes	Land & Title	Some	Awards generally high
70	None	Subs	Changes as required	——	No	Operating	No	Never condemned
71	3–5	Settled area transm; urban suburb subs.	Some aerial cable, expanded UG use	No	Yes	Engg	Some agents	Higher prices
72	9 (site)	Res urban subs	HV rural dist	No	No	Operations & Engg	Some agents	Usually fair
73	None	Urban subs, potential subdivision transm R/W	No	Normally	Yes	Engg	Not usually	State law requires unanimous jury decision
74	2	Transf subs, OH transm	UG, aerial cable	On separate projects	——	Dist Engg	Some	No recent cases
75	None	City subs	No	Fair appraisal	——	——	——	Never condemned
76	3–5	Suburb sites; indus, commercial R/W	UG taps; urging uniform zoning, state review authority	Yes	Yes	Legal	Yes	No trend
77	2–5	Urban sites, farm lands	Some aerial cable	Per linear distance or acre	Some	R/W	Some	Reasonable
78	Occasionally	Highway crossings, urban	HV lines	Per acre	Yes	R/W & Real Estate	Agents	Exceed appraisals about 30%
79	3–5	Potential developments	UG network	Yes	No	Engg	Rarely	Fair
80	10–20	Out of state ownership	Some UG	Per acre	Yes	R/W	Rarely	Fair
81	1–10	High urban fringe prices	Some aerial cable, UG, EHV	Per 100 ft	Yes	Operating	Sometimes	Generally favorable
82	1–4+	HV transm over small ownerships, suburb subs	13.8-kv dist, 115-kv for indus, 230-kv transm	Per rod-transm, per acre-sites	Yes	Engg	Agents	Not extreme
83	None	HV transm, congested area subs	Aerial cable, UG	Fair market value	——	Engg	No	No proceedings
84	3	Built-up area R/W	Aerial cable, EHV, UG if applicable	No	Yes	R/W	Some agents	Fair

Abbreviations: Co—Company; Corp—Corporation; Dist—Distribution; Engg—Engineering; EHV—Extra-high voltage; HV—High voltage; Indus—Industrial; Max—Maximum; Metro—Metropolitan; Mgr—Manager; OH—Overhead; Res—Residential; Sub—Substation; Transf—Transformer; Transm—Transmission; UG—Underground.

A Program for Revitalizing the Teaching of Electric Power

1. Designation by a properly authorized college-industry committee of those schools (perhaps 24) especially qualified in the way of staff, equipment, curricula, and interest to teach electric power. These schools should be at strategic geographical locations throughout the country so as to be near industrial power centers. The committee organization and constitution could probably best be established jointly by AIEE, ASME, and ASEE.

2. Subsidization by industry and electric utilities of one or more outstanding professorships in electric power at each of the above designated schools. These professors for the most part would have to be recruited from industry itself.

They should be original creative thinkers with a wide and detailed experience in the power field. Preferably they should be of the type who themselves have made worthwhile contributions to theory and practice and who understand something of the art of teaching. Their salaries should be in the $12,000 to $15,000-a-year bracket. They would be encouraged and expected to do a reasonable amount of consulting work with the power industry so as to keep up on current practice and developments.

Industry itself should take the lead in establishing these chairs. The principal manufacturers and the major utilities should set up and implement the establishment of these chairs as a joint venture so that the cost and the benefits could be equitably distributed.

3. Provision by industry to loan or donate the necessary laboratory equipment including modern machinery, instruments, network analyzers, computers, and high-voltage testing equipment. Many college laboratories need renovation and modernization. Many institutions will be able to buy the necessary equipment, but those which are not should be aided by industry. It will prove to be a profitable investment.

4. A well-organized propaganda campaign to interest students in the study of power. This should be handled by the joint venture organization in conjunction with the colleges concerned.

5. Provision by industry of a number of scholarships or fellowships in the power field to assist needy students and attract outstanding men.

6. Arrangement between industry and the colleges for summer employment of both instructors and students in the power field.

Power Teaching Can Be Revitalized

Dean of Engineering at Lehigh University . . .

- **Tells why teaching of electric power in colleges has deteriorated**
- **Refutes arguments that all power problems have been solved**
- **Suggests requirements for a strong power option**
- **Outlines program to give industry all the engineers it needs**

DR LOYAL V. BEWLEY, Dean, College of Engineering, Lehigh University, Bethlehem, Pa.

The teaching of electric power in colleges has steadily and dangerously deteriorated since the war. Today the power option has disappeared in most schools and has become much the weaker branch in many others. In fact, only a few—perhaps not more than a half dozen—electrical engineering departments are still doing a good job teaching power. The causes for this are three:

1. The glamor and apparently greater opportunities of the new and rapidly expanding field of electronics.

2. The attrition and exodus of outstanding teachers of power to industry.

3. The tardiness of the electric utility industry in awakening to the situation.

Student interest in electrical engineering has shifted to approximately 90% in favor of electronics and communications. There is a decided opinion among students that electronics offers a greater challenge to inventiveness, higher grade analysis, and development of new ideas.

The feeling is often expressed that all major power problems have been solved and that little prospect remains for original and creative advances. The notion that power has reached its ultimate intellectual level and is now in its stagnation phase is held by many students and teachers.

The corps of great teachers in electric power who held the stage three decades ago have died or retired. There has been practically no replacement because the younger men have gravitated to industry where they earn far better salaries and are closer to current developments than is possible in an educational institution. Today the really outstanding teachers of electric power in the 150 or so engineering schools—outstanding in the sense that they have made worthwhile contributions in the power field and are recognized authorities—can be counted on the fingers of one hand.

There are still many good teachers who are familiar with and doing a competent job in teaching power subjects. These are not leaders or acknowledged authorities. Rather they are the wheel-horse type who have never known the thrill of doing something new and different and of pioneering new developments. They lack the quality of great en-

gineering leadership. And without such leadership in a teaching staff, the necessary enthusiasm and esprit de corps in a student group does not materialize. It takes real authorities, men of stature, to attract and interest good students in any discipline.

Public utilities are no longer getting the better class of engineering graduates or enough of the type they do get. Many of them seem to feel that an outstanding engineering staff is not too necessary in their field. This attitude reflects itself in the relegation of research and development to manufacturers. The percentage of the engineering staff holding advanced degrees in the public utility industry is probably the lowest in any major industry except possibly the construction industry.

Power Theory Now More Complex

Even though sizes and voltages have increased many fold, the basic elements of power equipment (generators, motors, transformers, circuit breakers, transmission and distribution circuits, insulation, lightning arresters, relays, etc) have changed little in form or essential parts over the past 50 years. But design has become more intricate and theory more complex and refined.

It is also true that the great generalizations in power theory have been rather thoroughly worked and exploited. These include transmission line equations; the modern two-reaction theory of synchronous machines as developed by Doherty, Nickle, Park, and others; surge phenomena; law of corona, etc. But much remains to be done in the way of extension and refinement.

Furthermore, all problems in power have not been solved. As apparatus grow larger in capacity and higher in voltage, new problems develop. Higher ratings of machines have put emphasis on new and more effective methods of heat dissipation. This in turn has brought about radical changes in design. Increases in voltage have forced major changes in use of insulation and control of electric stress distribution, corona, and radio interference. Vast power pools have brought to a head as yet unsolved problems in economical load distribution, power transfer, and relay protection which are of little consequence for smaller installations.

The general equations and their solutions for a single synchronous machine are well established and understood, but the solution for the multiple machine problem is at present only approximately solvable. Characteristics of the electric arc, which plays such a cardinal role in circuit breakers and arcing grounds, have not been worked out satisfactorily. Lightning arresters need to be greatly improved. Insulation properties have yet to be investigated. Ultra-high voltage transmission, by virtue of split conductors, has posed new problems in reactance, capacitance, and corona calculations.

Utilization of analog and digital computers in machine design calculations and in solution of complex interconnection and stability problems is only started. Rotating machine theory offers a higher and more involved field for mathematical and theoretical studies than do electronic circuits because rotating machines are inherently cases of "moving electro-dynamic media;" where as electronic circuits and devices present cases of only static stationary media.

From a top level theoretical standpoint the difference is this. Maxwell's equations are sufficient for defining fields associated with electronic devices and radiation. But the much more involved Maxwell-Lorentz equations are necessary in the full treatment of rotating machines. As a result, matrices suffice for much of the analysis of the electronic circuits, but the higher aspects of the more powerful and general methods of tensor analyses need be involved for electric machines.

Some Electronics Courses Surplus

There is another subtle misrepresentation of the true state of affairs of the field of electronics as compared with that of power. Anyone examining a university catalog and noting the large number of courses available in electronics as compared with those in power would naturally conclude that the former is a far more expansive field. The truth is that the teaching of electronics is in a very chaotic and disorganized state. There is considerable duplication and a need for consolidation. Electronic people need to take stock and to recognize the true essentials of their field. They need to rewrite their texts and reestablish their courses so that attention is focused on the major essentials rather than the minor differences of their art. If this were done, electronics could be taught in a relatively small number of courses.

To meet the needs of utilities, apparatus manufacturers, and associated power groups, colleges should graduate about 2,000 men a year. About a third of these should have a well-developed analytical aptitude and have adequate training in the mechanical engineering aspects of power including machine design, vibration problems, thermodynamics, heat transfer, prime movers, and power plants. The modern power engineer must be familiar with both electrical and mechanical power. In fact, the mechanical problems of large power apparatus are often more critical than the electrical.

Profs Need Practical Experience

A college graduating 20 to 40 power option students per year should have at least one experienced professor who is a recognized authority in the power field. In addition there should be a number of younger teachers. Provision should exist for the professors to do consulting work and for the younger teachers to secure summer employment in the power industry.

Unlike in the field of electronics it is not feasible for instructors of power to obtain worthwhile practical experience within the university. They must gain this indispensable practical experience in industry through consulting and summer employment.

A college undertaking a strong power option should have adequate laboratory equipment. This means a well-equipped machinery laboratory, a network analyzer, and perhaps a high-voltage testing laboratory. The latter would include a surge generator, cathode ray oscillograph, and measuring devices. Such equipment is expensive; so colleges must depend on industry to donate it or furnish it on a cooperative arrangement.

Finally, the curriculum must be modern and designed to meet the actual needs in the power field. It

must give proper emphasis to both the electrical and mechanical aspects of power engineering. Thus the requirements for a strong power option are:

1. Topnotch experienced instructors.

2. Adequate laboratory equipment.

3. A modern curriculum.

It must be admitted that the majority of engineers with a public utility need not be highly qualified theoretical and analytical types. Higher theory and mathematics are of little use in the operating divisions, construction, or even some design. But in the systems engineering division and in design there is a greater need than many utilities (particularly those who depend entirely on manufacturers to do their engineering) admit. It is believed that a curriculum in power engineering should be designed to:

1. Meet the requirements of both types of utility engineers as well as of apparatus design and development engineers.

2. Recognize that there are "two ends to the shaft of a turbo-generator—a steam turbine on one end and an electric generator on the other." In other words a power engineer is a combined electro-mechanical engineer familiar with all aspects of his job.

To this end the appended five-year power curriculum, leading to a master of science degree, is suggested. This curriculum may be terminated with a bachelor of science degree at the end of four years for those who are not qualified or interested in higher analytical work and do not intend to pursue their careers in research, development, or system engineering.

Suggested 4 and 5 Year Curricula in Electric Power

FIRST YEAR

1st Semester		2nd Semester	
General Chemistry I	5	General Chemistry II	5
English I	3	English II	3
Humanistic-Social I	3	Humanistic-Social II	3
Math I	3	Math II	3
Engineering Drawing	2	Engineering Drawing	2
Military Science	2	Military Science	2
	18		18

SECOND YEAR

Metallurgy	3	Math IV	3
Math III	3	Strength of Materials & Lab.	4
Statics	3	Physics II	6
Physics I	4	Economics II	3
Economics I	3	Military Science	2
Military Science	2		
	18		18

THIRD YEAR

Math V Advanced Calculus	3	Math VI Advanced Calculus	3
Dynamics	3	Fluid Mechanics & Lab	4
Modern Physics	4	Electric Mach & Lab I	4
Electric Circuits & Lab	4	Electronics & Lab	4
Electrical Measurements	1	Humanistic-Social IV	3
Humanistic-Social III	3		
	18		18

FOURTH YEAR

Electric Mach & Lab II	4	Electric Mach & Lab III	4
Transmission Lines	3	Symmetrical Components	3
Electric Transients & Lab	4	Machine Design I	3
Thermodynamics & Lab I	4	Thermodynamics & Lab II	4
Humanistic-Social V	3	Humanistic-Social VI	3
	18		17

FIFTH YEAR

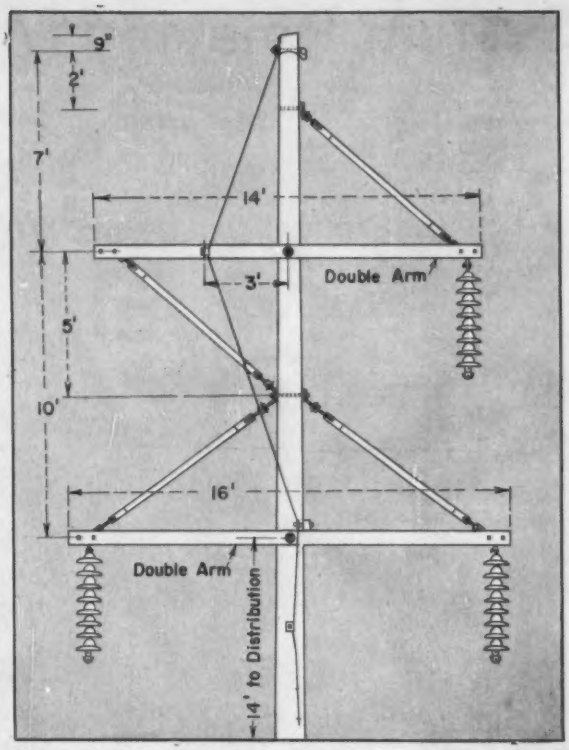
Advanced Machine Theory & Lab IV	4	System Stability & Lab	4
Surge Phenomena & Lab	4	Electric & Mag Fields & Lab.	4
Compressible Fluids	3	Heat Transfer	3
Steam Turbines & Lab	4	Power Plants	3
Machine Design II	3	Vibration Problems & Lab	4
	18		18

Curriculum Advantages Noted

The following points should be noted about this curriculum:

- It is approximately equally strong for both the four and five-year programs in both electrical and mechanical engineering, and the education in these branches runs in parallel.
- It provides tightly integrated and coordinated sequences in mathematics, science, electrical and mechanical engineering, and humanistic-social studies. Each course in a sequence is built on the preceding courses in that sequence and becomes a prerequisite for subsequent courses so that maximum educational advantages are secured.
- The curriculum is intentionally strong in mathematics and basic science, and no course is attacked until adequate tools have been provided by prerequisite courses. More than the usual number of credit hours have been allotted to chemistry and physics in order to allow time for some consideration of modern atomic and solid state physics.
- The more advanced problems in both the electrical and mechanical sequences have been left for the final or fifth year.

138-KV LINE carries 1,351,500 circ mils, aluminum conductors. Below is 477-MCM, aluminum-conductor 12-kv line



SINGLE-POLE DESIGN for the new 138-kv line permits adjustment for maintaining tension on the crossarm braces

Single Poles Carry 138-Kv Line

A single-pole, 138-kv line having 1,351,500 circ mil aluminum conductors has been designed and built by Dayton Power & Light Co for a 1½-mile section along a highway where there was no room for H-frame construction. On the line there is also a 477,000 circ mil aluminum conductor, 12-kv circuit.

The single-pole structures, designed for heavy loadings, have braces adjustable at both ends. One end fits against and is fastened to the pole with a curved, spiked malleable iron shear plate which grips the wood. Braces are attached to cross arms with special fittings in the double arming spacers.

Structures are built on the ground and raised into position when completed. Braces are adjusted to give a slight uplift to the end of the arm before it is loaded. Weight of the conductors brings the ends into their normal position. Poles are 75 and 80 ft class 1. Maximum spans are 230 ft. The line will operate initially at 69 kv.

STRUCTURES of the 138-kv, single-pole line were assembled on the ground, and complete structures were then raised into position along the 1½ miles

BRACE, adjustable at both ends, fits against pole and is fastened by a spiked, malleable iron shear plate. The brace attaches at arm to double arming spacer

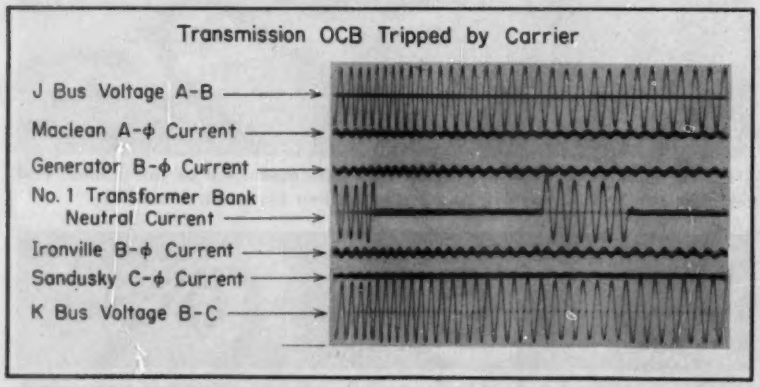
System Relaying Modernized

RELAYING Protection

Three-year $500,000 Toledo program, nearing completion, brings benefits to system operation and customer service

LEROY E. SMITH, Electrical System Design Engineer, Toledo Edison Co, Toledo, Ohio

JUNCTION CABINETS for current transformer are employed with bus differential relays to facilitate connections and to provide a means of testing



SHORT CLEARING TIME is an improvement of modernized system relaying. Toledo uses protective equipment that keeps pace with overall growth

Toledo Edison Co is putting the finishing touches on a $500,000 relay modernization program. This three-year project has improved system operation and customer service by utilizing protective equipment that keeps pace with over-all system modernization and growth.

The program has reduced the number of incorrect breaker operations and the length of voltage depressions to a minimum in most cases. An oscillogram of typical faults shows a relatively short clearing time. Before the program, some faults had to be cleared by back-up relays and took much longer clearing time.

In 1953 the system consisted of several 69-kv lines serving metropolitan Toledo. The principal generating station fed the system at 69 kv. Tie lines with two neighboring utilities were 138 kv, one serving two division subtransmission systems of 34.5 kv.

The 138-kv system was generally well protected by high-speed carrier and transformer differential relaying. The 69-kv lines had high-speed pilot wire relays with over-current directional relays as back-up protection. While some principal buses and transformers were protected by current differential relays, several buses and transformers depended upon the transmission line back-up relays.

The 34.5-kv system, except for a few newer circuits, was protected by overcurrent directional relays. Modern high-speed impedance relaying was installed on the more recent 34.5-kv circuits.

The company analyzed system relaying with reference to length of voltage dips and their adverse effect on power plant auxiliaries, customers, system stability, equipment damage, and length of outages from transformer or bus faults. It was decided that the following should

be the criteria for system protection:

• All faults on the transmission or subtransmission system should be cleared at a high rate of speed.

• The scheme should give primary consideration to protecting the system and secondary consideration to protecting the equipment.

Virtually all circuit breakers on the system were of a fairly modern design, operating in 5-8 cycles. Therefore, high-speed relays operating in 1-3 cycles were required. It seemed highly desirable that all major faults be cleared in less than 10 cycles. But it was not considered necessary to clear distribution faults so speedily.

Program Is Extensive

The relay program consisted of:

1. Replacing phase overcurrent directional back-up relays on 69-kv circuits with high-speed reactance-type relays and ground overcurrent directional relays with modern high-speed overcurrent directional relays. Impedance relays with reverse current elements were used for phase protection on 69-kv lines terminating in transformers.

2. Adding differential relaying at major substation buses.

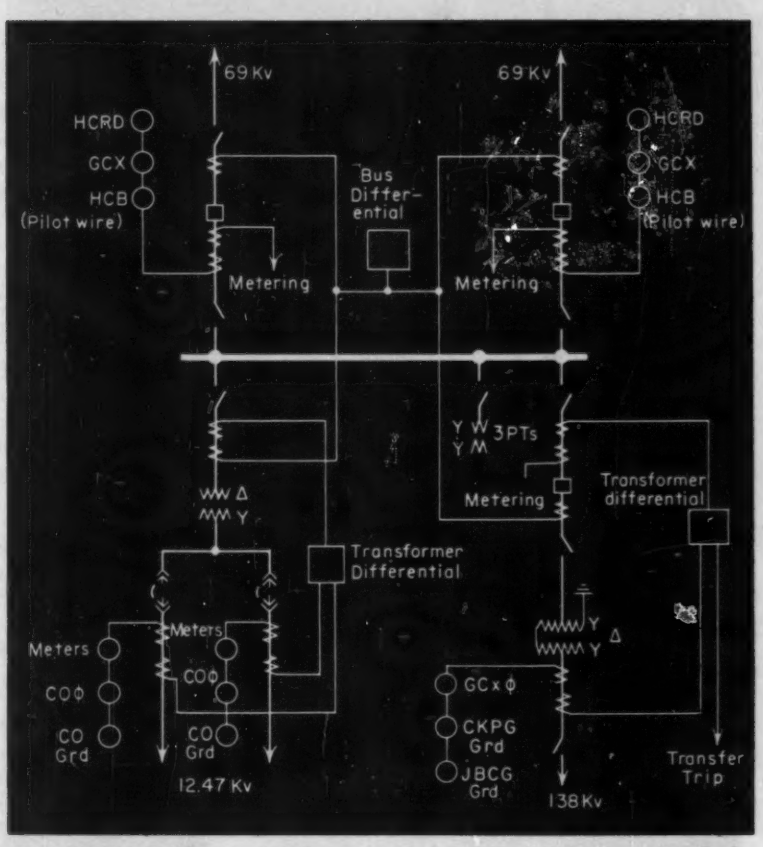
3. Adding differential relaying on substation transformers.

4. Replacing phase overcurrent directional relays on 34.5-kv circuits with impedance-type relays and ground relays with modern high-speed overcurrent directional relays.

Reactance-type relays for 69-kv lines were chosen as back-up protection for substation buses and lines and for pilot-wire relays out of service. It was believed that reactance relays would perform best on short 69-kv lines as they measure reactance but neglect arc impedance.

Reactance ground relays were not used because of high cost and panel space required. Panel space was usually at a premium. Adequate protection could be obtained with a high-speed overcurrent directional ground relay.

On principal substation buses a voltage-type differential relay was used with conventional CT's. This type was selected because of the difficulty in applying an overcurrent differential relay on substation buses with several circuits. The current percentage differential relay with harmonic restraint was applied on transformers. Overcurrent relays were chosen to protect substation secondary buses excluded from transformer differential relay protection.



PILOT-WIRE PROTECTION of 69-kv circuits is first line of defense against faults while combination of relays provides back-up protection for this substation

An example of the new protective scheme appears in the diagram of a typical substation. It shows the protection of 69-kv circuits with pilot wire as first line of defense against faults. Phase-reactance-type relays and a high-speed directional overcurrent ground relay provide back-up protection. It also shows high-speed reactance-type relays employing carrier on the incoming 138-kv line and overcurrent percentage differential relays on the 138/69-kv autotransformer and 69/12.47-kv transformer. In the case of the latter transformer, the secondary bus is included in the transformer differential protection.

Relaying on distribution feeders was not modernized. It consisted of three overcurrent phase relays and one overcurrent ground relay and was considered adequate.

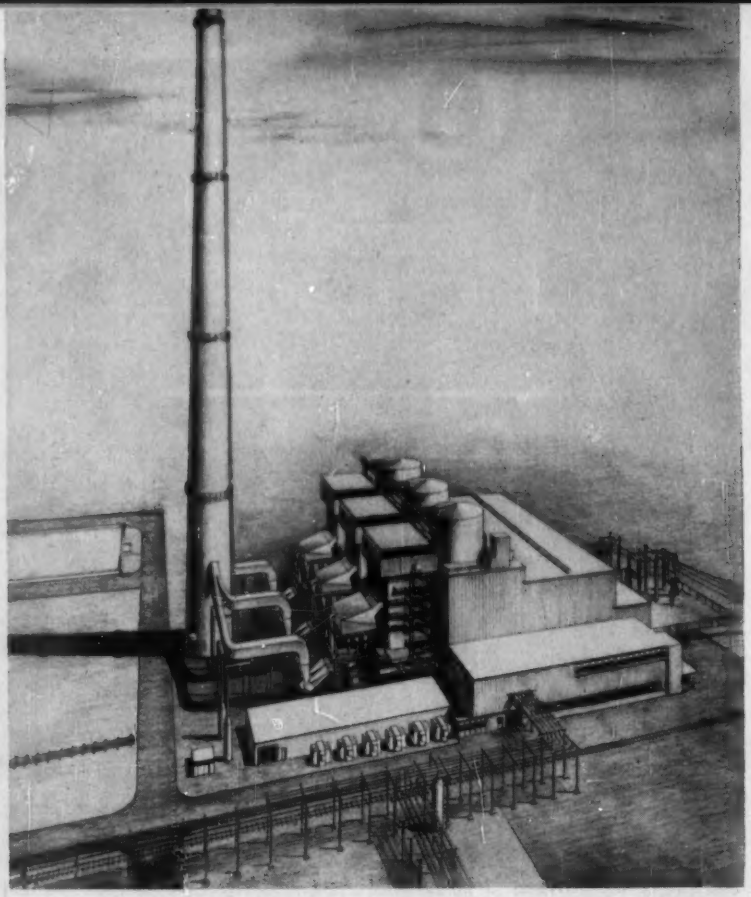
Modernization was difficult to complete because of expense, engineering time, and the necessity of getting outages to equipment for installation work. The basic design of the protective systems was chosen to permit standard components—relay panels, CT's, junction cabinets, and similar equipment—to be used repetitively at as many substations as possible.

Installation of relay panels in control houses required considerable re-routing of control cable and ingenuity in running conduit and installing panels. In general, the high-speed reactance relays were placed alongside the corresponding relay and control panels if extensive rearrangement was not required.

In some cases panels with reactance relays were installed at other points, and the panels were re-arranged later. The ground relay was usually placed on the original relay and control panel.

One large expense item in the

(*Continued on page* 120)



500-FT STACK is provided to handle stack gas from the burning of all kinds of fuel. The stack is reinforced concrete with full height acid-proof brick lining

GENERATION—Design

First Plant Designed to Burn Fluid Coke

Oil refinery byproduct will be burned in Delaware P&L Co plant. Station will also supply process steam to adjacent refinery

W. C. CAUTHEN, Consultant, C. F. Braun & Co, Alhambra, Calif.

A net station heat rate of 8,700 Btu per kwhr and a power generation efficiency of 43% are expected to be attained at the new Delaware City Station of Delaware Power & Light Co. This station is being built in conjunction with a new refinery of Tidewater Oil Co. Like Linden Plant of Public Service Electric & Gas Co (EW, April 9, 1956, p 16), it will supply the refinery with power and process steam. The refinery will furnish the power plant with fuel, treated water, and cooling water. But the fuel used will not be high viscosity bunker C oil as at Linden but fluid coke.

Fluid coke has been burned in utility boilers on an experimental basis (EW, Dec. 5, 1955, p 22), but this is the first power plant that has been designed to burn it.

The plant will have two 25-Mw, 3,600 rpm extraction-condensing turbine-generator units. Process-steam requirements at the refinery are approximately 800,000 lb per hr maximum. To supply these two demands for steam and power, the station has three two-drum, water wall-type, slag-bottom boilers. Together they generate a total of 1.5 million lb per hr of superheated steam at 1,300 psig and 950F.

Fluid coke is the end-product of a refining process developed and patented by Esso Research & Engineering Co. It differs greatly from conventional petroleum coke. Particles are small, like beach sand. They pour freely and are clean in comparison with other cokes. Fluid coke burns with less than ½% fly ash. The heating value is above 14,000 Btu per lb.

The chemical analysis of the coke is above 90% carbon in all cases, but varies with the grade of crude oil. As fluid coke is a new product, a firm market price has not as yet been established. It will be competitive with bituminous coal.

Fluid coke will be blown by compressed air through pipelines from a storage silo in the Tidewater refinery to the power plant. Three separate 5-in. lines are provided, one for each boiler. Operating air-pressure will be about 90 psig. Storage tanks at each boiler hold 1,050 tons or some 42 hours at full steaming-capacity.

Supplemental fuel such as oil or gas is needed to bring the coke to ignition temperature and to maintain combustion. The boiler design is based on 10% supplemental fuel. But some firing tests indicate successful operation down to as low as 5%. However, more actual operating experience is needed to pinpoint any value lower than 10%.

Three boilers were specified to insure against any service interruption. Two will carry the normal full-load steam and power requirements of the refinery. And two turbine-generators give the best operating reliability. Backing up the turbines is an independent 69-kv tie-line from the Delaware P&L Co system.

Adapted from a paper presented by the author at the AIEE Summer General Meeting, San Francisco, June 1956

The power station must supply a fairly wide range of loads depending on the kind and quantity of crude oils being processed and on the particular operating cycle. Demands for 600 psig process-steam may vary from as little as 300,000 lb per hr to as much as 800,000. Process-steam at 600 psig, 750F is delivered in two main steam-headers from a controlled back-pressure extraction point on each turbine.

Power demands may vary from a low of 18 Mw to a peak of over 40. Refinery electric power is supplied at 13.8 kv. The 69-kv transmission line will serve an important function in that it receives surplus power from the power station or supplies needed power to it as the case may be.

Special engineering problems had to be solved to burn this new fuel. Fly-ash from certain crude oils has a fusion temperature somewhat higher than is ordinarily encountered. For this reason the slag-bottom furnaces have provisions for the addition of a flux such as calcium-oxide or magnesium. Special ash doors have also been provided. And special provisions have been made for measuring the temperature at the bottom of the furnace.

Considerable research and engineering were needed to develop a satisfactory pulverizer. Attrition mills are provided at Delaware City Station. Three pulverizers are provided for each boiler. Each is driven by a 500-hp induction motor. Tests indicate that a fineness of about 85% through 200 mesh can be obtained when pulverizing coke at the rate of 25 tons per hr per boiler. About 450 kwhr is needed to pulverize 8.3 tons of coke, or roughly 54 kwhr per ton. But successful firing tests have been made with as little as 66% through 200 mesh, hence 35 to 40 kwhr per ton seems the more likely value. Full scale operation is required to determine the fineness actually needed and whether the power consumed will be greater or less than for coal.

An ash-reinjection system is provided. It draws fly-ash from the bottom of the dust collectors and carries it back to the pulverizers. Here again operating experience must determine what amount of carbon will be recovered.

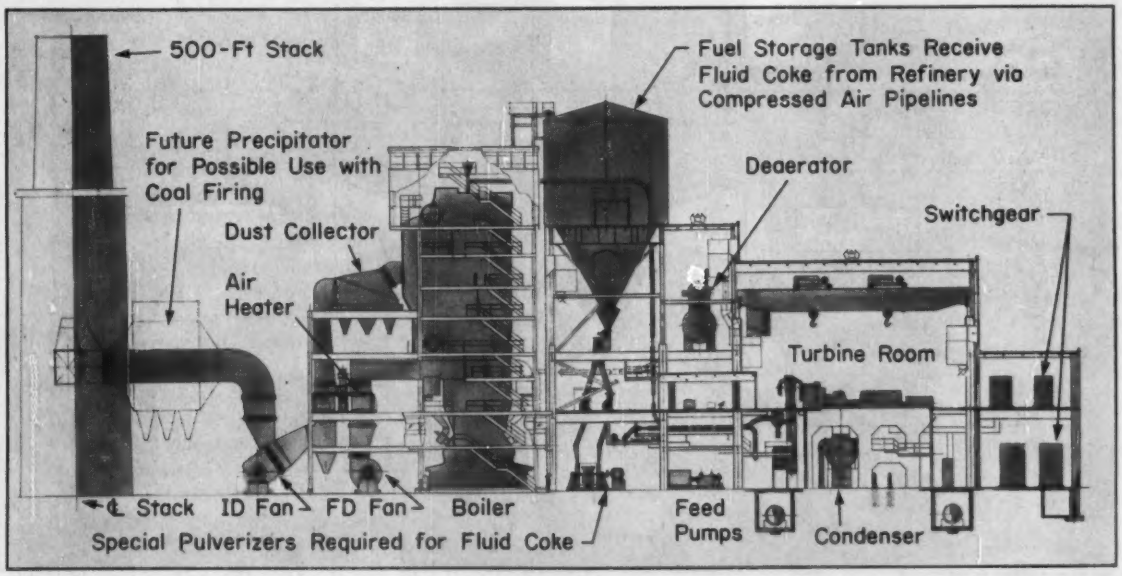
Firing tests on fluid coke do not indicate the need for precipitators at this time. The smoke density during these firing tests was much less than for coal firing. In fact, smoke density meters registered zero for some of the tests. But space has been provided for electrostatic precipitators for possible future need, say with coal firing.

One central treating plant supplies makeup water for both the refinery and the power station. Pretreated water goes to the power station for general utilities. Demineralized water is supplied for boiler feed. This makeup may be as high as 40% under certain operating conditions.

There are four steam-levels in the power station. Automatic extraction to the refinery is at 600 psi, 750F. Station-auxiliary steam is 175 psi, 425F. And 40-lb steam at 380F is used for space heating and steam tracing. Pressure-reducing and desuperheating-stations make up the deficiency at any level from the 1,300-lb main-header.

Bus-duct, circuit-breakers, and switchgear are arranged for the installation of a future generator. An outdoor substation and switchyard connects to the Delaware P&L 69-kv system. Two 20/26.7/33.3-Mva transformers provide 100% standby capacity. The 13.8-kv switchgear serves some 28 feeders to the refinery plus station auxiliary loads. Utilization voltages within the power station are 2,400 and 440.

The two turbine-generators are 25-Mw, 3,600-rpm, extraction-condensing units. Each is designed for a maximum throttle-flow of 750,000 lb of steam per hr at 1,250 psig and 950F. The minimum extraction-rate at full nameplate rating of each generator is about 400,000 lb per hr. The maximum practical extraction-flow is about 520,000 lb. With no 600-lb ex-



PRO-RATA SHARE of the initial capital investment chargeable to the production of power is estimated at about $160 per kw of nameplate capacity. This compares favorably with costs of other modern plants in the same general area

Process-Steam Generating Plant Has Low Heat Rate

Total boiler steam generated	= 990,300 lb per hr	H = 1,468 Btu per lb
600 psig steam to refinery	= 540,000 lb per hr	H = 1,381.5 Btu per lb
Refinery condensate returned	= 310,000 lb per hr	h = 61 Btu per lb
Demineralized water temperature	= 65F	h = 33 Btu per lb
Boiler blowdown	= 1,200 lb per hr	h = 593 Btu per lb
Boiler efficiency	= 86%	
Total power generated	= 47,600 kw	
Station power required	= 9,500 kw	
Power to refinery	= 38,100 kw	

Heat absorbed*

$(990{,}300)(1{,}468) - (960{,}300)(427.7) - (30{,}000)(249.8) = 1{,}034{,}000{,}000$ Btu per hr

(Steam from Boiler — Feedwater — Desuperheating Water)

Heat chargeable to refinery

$(540{,}000)(1{,}381.5 - 61) + (230{,}000)(61 - 33) = 720{,}000{,}000$ Btu per hr

Power required to make refinery steam 5,180 kw

Correcting for lower feedwater pressure—5,180 − 1,000 = 4,180 kw

Power required for power generation

9,500 − 4,180 = 5,320 kw + 280 kw** = 5,600 kw

Net Station Heat Rate

$$\frac{1{,}034{,}000{,}000 - 720{,}000{,}000}{(47{,}600 - 5{,}600)(0.86)} = \frac{314{,}000{,}000}{(42{,}000)(0.86)} = 8{,}690 \text{ Btu/kw-hr}$$

*Neglecting 200,000 Btu per hr absorbed by blowdown.

**Includes pumping 30,000 gpm of cooling water against 25-ft head and portion of water-treater load.

Notes: 1. All heat contents base on zero for liquid water at 32F.

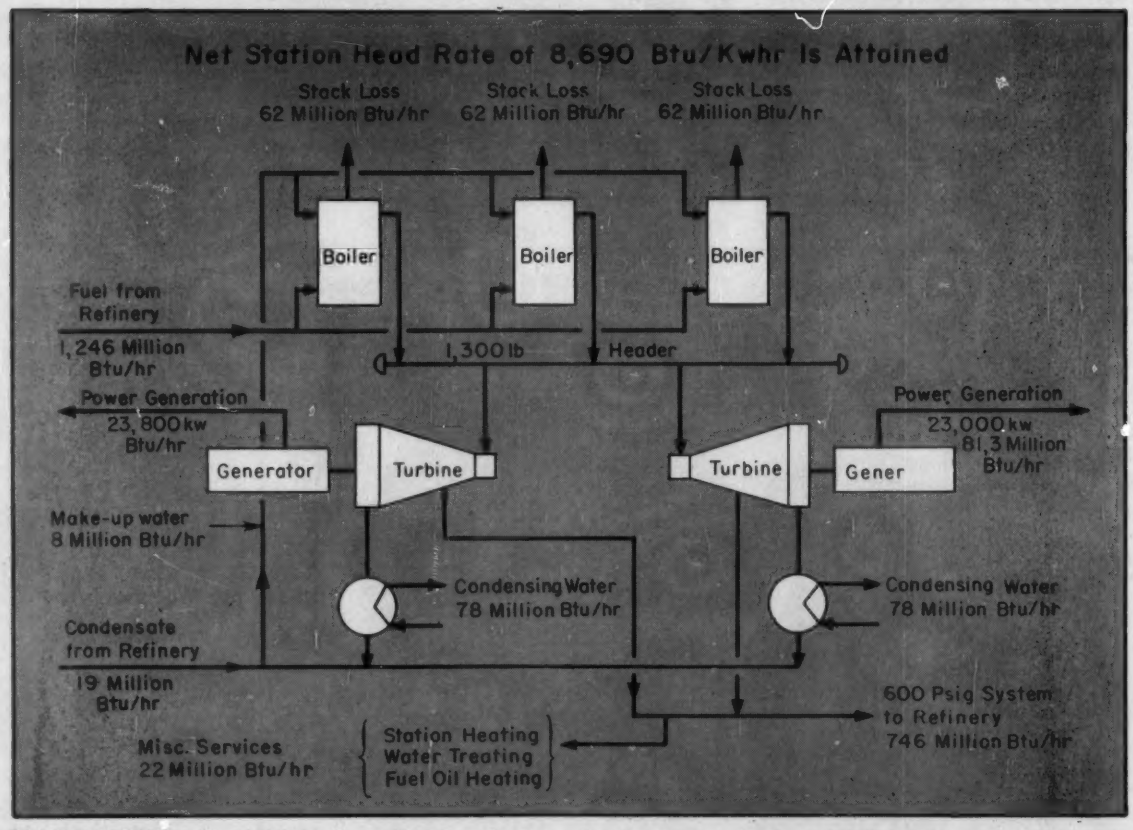
2. Power requirements for generating 600 psig steam are assumed to be the same as for 1,300 psig steam, except for the power required for feedwater pumping. Station power requirements shown here are somewhat higher than usual, because the fluid coke fuel is harder to pulverize than coal.

traction, each unit will deliver 20 Mw. The generators are rated 32 Mva at 85% power factor with hydrogen cooling at 30 psig. Generator output is 13.8 kv, 60 cycles.

A 500-ft stack is provided to handle the stack gas from the burning of all kinds of fuel. The stack is reinforced concrete with full height acid-proof brick lining. It is designed to serve the present three 500,000-lb-per-hr boilers plus a future boiler of the same capacity.

Condensing water is pumped from the Delaware by the refinery pumping station. A 60-in. pressure-line provides 45,000 gpm of water to the power station. A 66-in. gravity-outfall line returns the water to the river. Combining all of the equipment into one pumping station for both the refinery and the power station lowered the capital investment and will reduce operating and maintenance costs.

Power plant will be owned and operated by Delaware P&L Co. Water treatment plant is operated and maintained by Delaware P&L.



PROCESS STEAM for the oil refinery is supplied from the turbine extraction points, but pressure reducing and desuperheating stations on the 1,300-lb header can make up any deficiencies. Automatic extraction is at 600 psi, 750F

BALLOON, inflated with helium gas, is raised to position by engineers with guys attached for controlling it. When balloon is in proper place it is secured

FIELD MAN on plumbing transit radios "On target" to control 2 miles away

TRANSMISSION—Design

Balloon Facilitates Line Survey Through Brush

WENDELL A. JOHNSON, Transmission Design Engineer, Toledo Edison Co, Toledo, Ohio

The old problem of running a centerline survey through trees and brush between points a mile apart was solved recently by Toledo Edison Co engineers who used a helium-filled balloon.

The balloon method proved to be much simpler and cheaper than chopping through the woods, measuring, checking the error, and repeating the survey until an accurate line was established.

The first attempt to find a substitute method for clearing for the centerline survey was made at night, using a spotlight at the target point in connection with two-way radio communication. The light, properly adjusted, showed up fine, but the transit crosshairs could not be seen without exterior illumination.

But when the crosshairs were illuminated, the light beam was no longer visible.

Deviates Only 9 Ft

The crosshair position was estimated and a line establishd to the next control point 1.3 miles away. The error was 9 ft, a better result than was obtained by other methods, yet not good enough.

A balloon was obtained, and for safety reasons, helium gas was used for inflating it. Three guys were attached, and the balloon was floated into position. A plumbing transit was used to plumb the balloon over the control point.

When the man with the plumbing transit radioed "On target" the man at the distant control point shot the balloon with another transit. The work was done by day.

Gusty winds on one occasion and insufficient helium gas on another brought failure in the first two attempts at using the balloon for the survey. On the third attempt, on a relatively calm day, the balloon was raised successfully 300 ft above ground. It was positioned, shot with the plumbing transit, and then shot and re-shot with the second transit 2 miles away.

To check the results, the line was chopped through between control points. Contrasting with the normal chopping-through error of as much as 50 ft, the error was less than 3 ft.

As the line was over a 2-mile stretch, this result was excellent.

(*More How To on page* 66)

ONLY ON THE GENERAL ELECTRIC I-55 METER:

$4.77 CAN BE

Tests, service prove General Electric I-55 meters can save you money

GREATER SUSTAINED ACCURACY

New test data on meter performance, compiled in G-E research laboratories, prove that General Electric's revolutionary "floating disc" meter provides high sustained accuracy which saves you money.

During accelerated life tests, identical loads were applied to the G-E I-55 meter and to meters with conventional bearing systems. The results are startling.

Here's the proof. Assume an average

GREATLY REDUCED TILT ERROR LOSSES

Any meter operating at even a slight tilt will give inaccurate readings that often result in loss of revenue. General Electric lab tests prove that I-55 meters with magnetic suspension "floating discs" are least affected by tilt—while the accuracy of meters with conventional ball bearing systems varies considerably with different angles of tilt.

Here's the proof. A conventional meter at one degree forward tilt, operating at a continuous average of 240 volts, 1.5 amperes, would lose .01728 kwhrs

NO PERIODIC BEARING REPLACEMENT

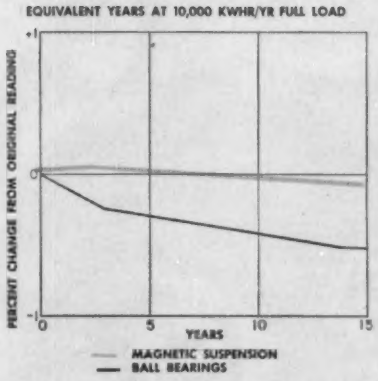
For complete details on how I-55 meters can save you money, call your nearby G-E Apparatus Sales Office. For information on the complete line of General Electric watthour meters, write Section 621-10, General Electric Co., Schenectady 5, N. Y.

TOTAL FIFTEEN-YEAR

GENERAL ELECTRIC

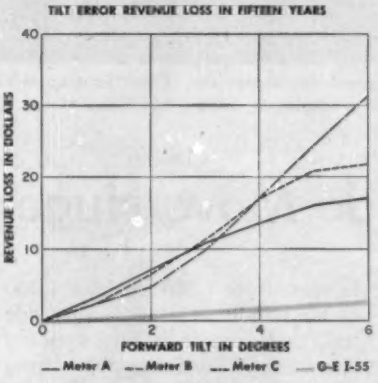
SAVED IN JUST 15 YEARS

kwhr usage per consumer (based on *Electrical World* forecasts) per year for fifteen years and the per cent loss on registration per year—the total loss in kwhrs would be 266.8 for a conventional meter. At two cents per kwhr, this means a gross loss of $5.34. By considering the "present worth" factor at 6 per cent interest for each year, the net loss on a conventional meter would be $3.14. The I-55 eliminates this loss and saves you the money.



$3.14

registration over the I-55 in 24 hours. In 15 years, the kwhr loss would be an amazing 94.40 kwhrs. Taking a reasonable figure of two cents per kwhr, the gross loss would be $1.89. By considering the "present worth" factor at 6 per cent interest for each of the fifteen years, the conservative saving realized by using a General Electric I-55 meter would be $1.29. And a glance at the chart on the right reveals much higher savings at tilt errors of 2 degrees to 6 degrees.



1.29

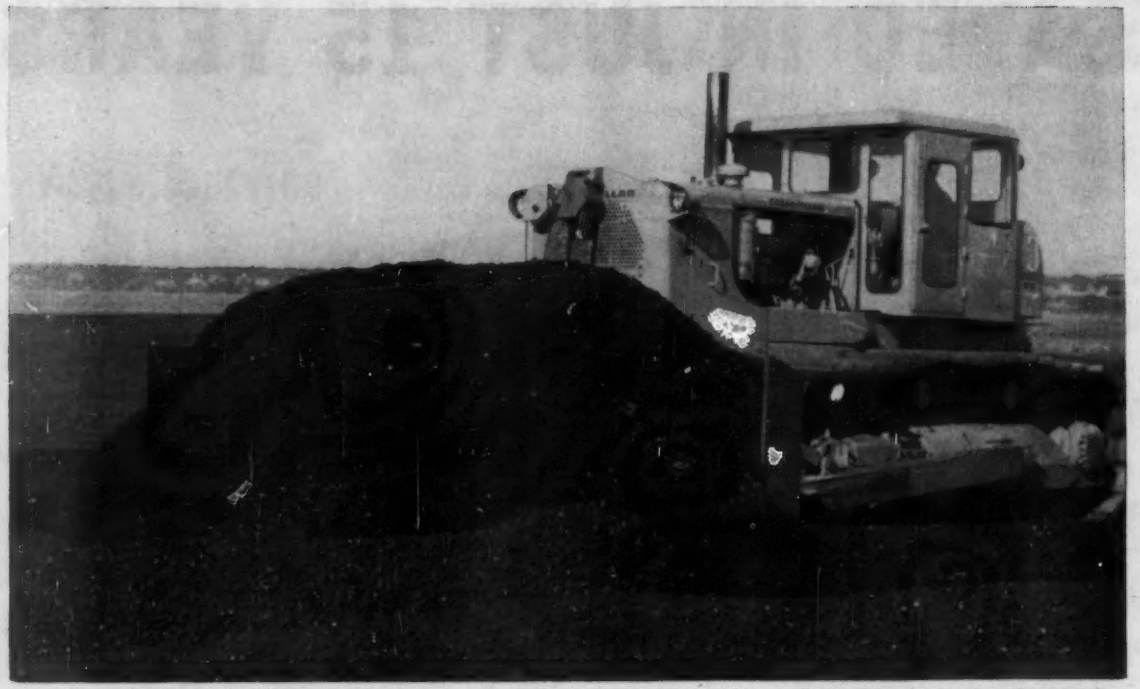
The trouble and expense of periodic bearing replacement is eliminated when you use General Electric I-55 meters with the "floating disc."

General Electric accelerated life tests prove that ball bearings in ordinary meters must be inspected and in many cases replaced after a comparatively short period of time. The G-E I-55 meter with magnetic suspension—and no bearings—showed no measurable wear even after the equivalent of more than 300 years of normal operation.

Bearing replacement is costly. Here's a typical example. Assuming replacement occurs after fifteen years' service, and taking into account an estimated average replacement cost and the "present worth" factor at 6 per cent interest, a conservative cost for bearing replacement on each conventional meter would be 34 cents. With no bearings to replace on the I-55 you save 34 cents on every meter.

.34

AVERAGE SAVING USING I-55 METER $4.77



TRACTOR with 20-ft U-blade was designed for materials handling. This equipment keeps the coal stockpile at Cobb Plant in step with an increasing demand and expanding facilities. It can push an average of 19-20 tons of coal

Tractor and Blade Move Huge Coal Tonnages

A tractor equipped with a 20-ft U-blade moves, with the minimum machines and operators, huge tonnages of coal onto the stockpile at the B. C. Cobb Plant of Consumers Power Co.

Recent tests showed that the big crawler, equipped with a materials-handling blade, can push an average of 19 to 20 tons. Over courses of 150 and 250 ft, the machine's production in tons per hr was 907 and 633, respectively.

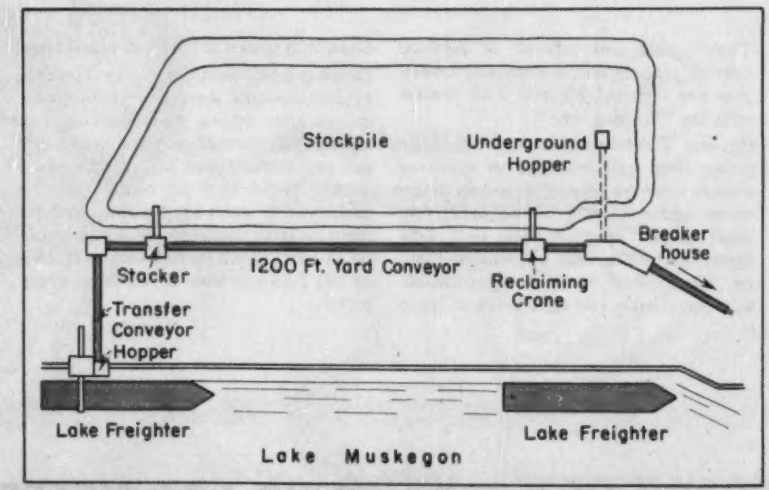
Has 198,000-Kw Output

Cobb Plant, a principal power source of the interconnected system, supplies power to 61 Michigan counties. It has been operating with three 66,000-kw turbines, giving a maximum total output of 198,000 kw. This summer a new 156,000-kw turbine started operation, and next spring another 156,000-kw unit will go on the line. These additions will bring the plant's total output to 510,000 kw.

Coal tonnages burned per day will increase from 1,800 to about 4,000 by the middle of 1957. To provide this coal requirement, the utility plans to increase the stockpile from 350,000 to 700,000 tons. This increase will present problems in economical handling at the plant.

To facilitate handling of the present stockpile and to prepare for the stockpile of the near future, the company needed material-handling

(*Continued on page* 70)



HIGHEST POINT of the coal stockpile, 35 ft high, is close to the reclaiming crane. Coal is dozed to the pile by the special tractor with 20-ft U-blade

Now! At Load Bonus Settings,
General Electric's new ML-32
Voltage Regulator . . .

IGNORES SHORT CIRCUITS

By D. D. MacCarthy, Manager—
Feeder Voltage Regulator Engineering,
General Electric Company.

With the advent of Load Bonus, which G.E. introduced last year, some utilities asked what effect short circuits would have on regulators operating on higher current settings. Now we can give this quick and categorical answer:

General Electric ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated below.

Load Bonus, of course, means that, at ±5% regulation, G-E ML-32 single-phase step voltage regulators are suitable for currents up to 160% of rating, to a maximum of 400 amperes.

Now, the ML-32's extra short-circuit strength allows you to take full economic advantage of the 60% Load Bonus feature in applications where previously short-circuit capacity has been a limitation. Check the chart below. You will note that, in all cases, the ML-32 regulator will withstand short circuits long enough for circuit-interrupting devices to go into action.

For more information on the ML-32, write Section 423-16, General Electric Co., Schenectady 5, N. Y. or contact your General Electric sales office or agent.

ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated at left.

Add load, maintain short-circuit capacity:

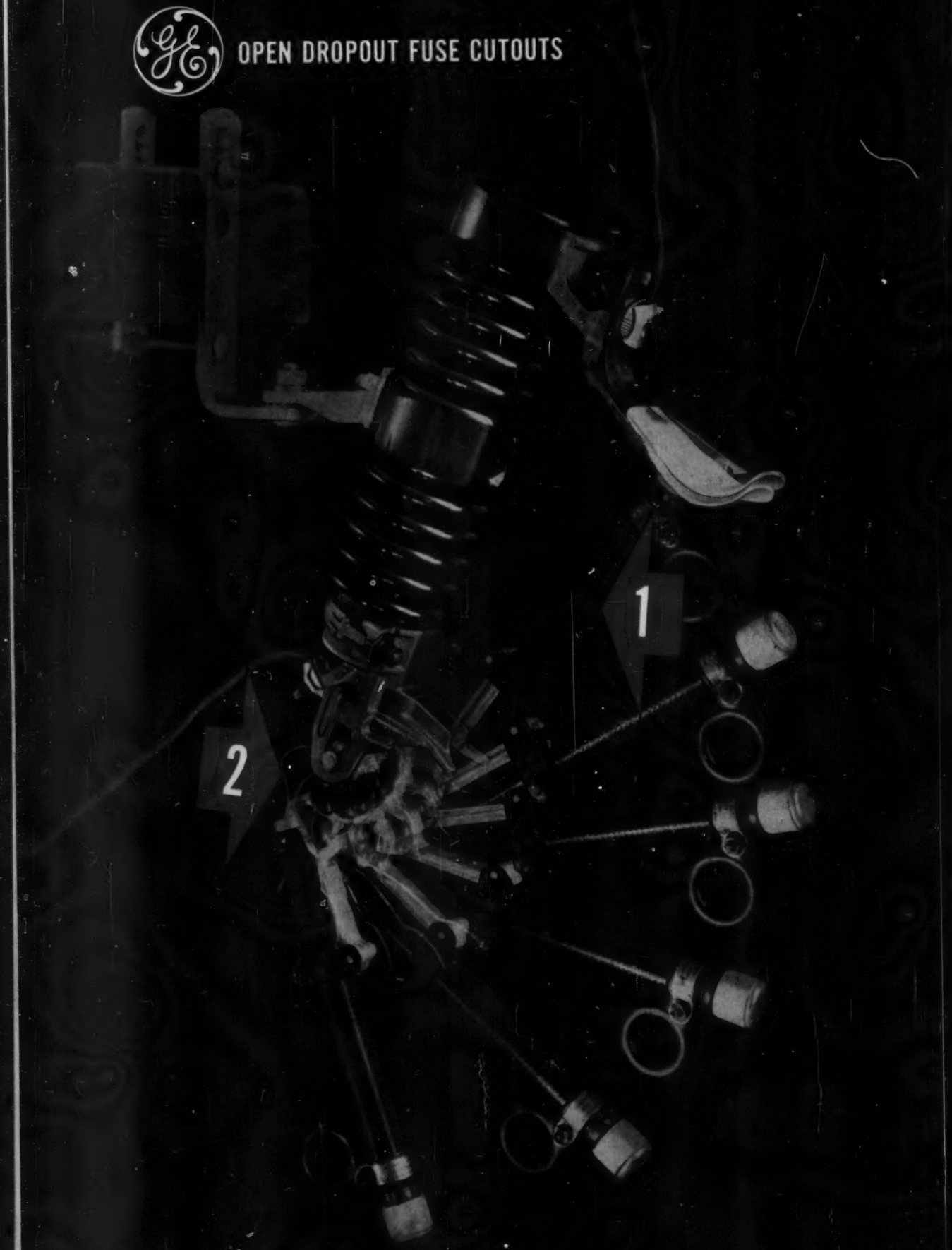
Regulating Range (Percent)	Load Bonus Current* (% of basic rated current)	Short-circuit Capacity** (% of basic rated current)	Short-circuit Duration (Seconds)
±10	100%	100% x 25	2.0
± 8¾	110%	110% x 25	1.6
± 7½	120%	120% x 25	1.4
± 6¼	135%	135% x 25	1.1
± 5	160%	160% x 25	0.8

*400 amperes maximum
**10,000 amperes maximum

Progress Is Our Most Important Product

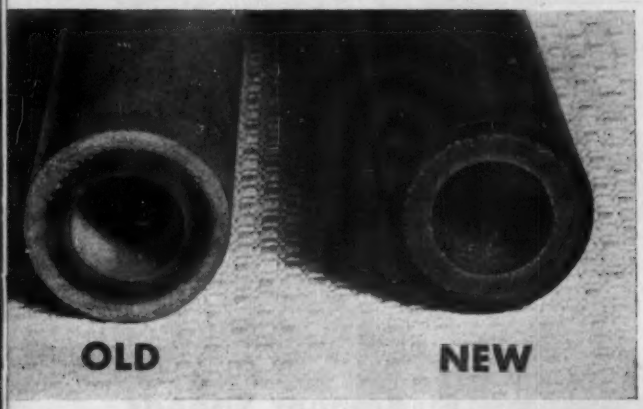
GENERAL ELECTRIC

OPEN DROPOUT FUSE CUTOUTS

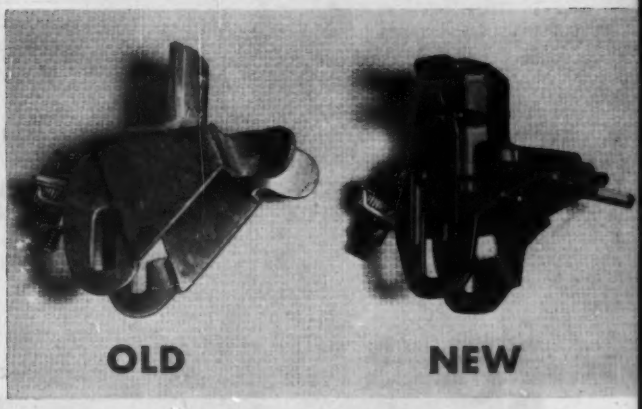


Now—even longer service life from General Electric Open Dropout Fuse Cutouts with

New Polyester Fuse Tube... New Bronze Fittings...



1 **COMPARISON OF OLD AND NEW FUSE TUBES** shows increased thickness of fiber is made possible by a new, thinner but tougher sheath of fiberglass reinforced plastics. More fiber lengthens tube life by allowing greater number of cutout operations with increased reliability.



2 **NEW CORROSION-RESISTANT BRONZE HINGE** (right) has dependable characteristics of old-type galvanized hinge, plus positive operation after years of service in corrosive atmospheres. Fuse-holder drops immediately when fuse blows, slams back easily after re-fusing.

General Electric's new Open Fuse Cutout gives you these important changes that assure even better performance, longer service life and mean fewer problems for linemen.

New fuse tube now features a tough outer protective sheath of reinforced polyester resin. It is practically immune from the effects of weather and age. Improved characteristics and greater strength of this new material permit a thinner sheath, allowing greater thickness of fiber to be used in the fuse tube. As a result, ***these new tubes stand up longer under repeated operations.***

New lower hinge of improved design, together with all component parts, is now made entirely of bronze, virtually ending corrosion problems encountered with galvanized fittings. Hinge won't stick—operates freely after years of exposure even in salt air and other corrosive atmospheres.

Other features include new hanger support construction, compression-clamped fittings, permanent high-pressure contact and latch, long lasting silver-plated contacts, complete bird-proof construction, optional load-break device and disconnect blade.

Heavy-duty ratings include a 15-kv, 100-ampere cutout with an interrupting rating of 4000 amperes and a 7.8-kv, 100-ampere unit with a 5000-ampere interrupting rating.

For complete information, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-20, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

Moves Huge Tonnages

(*Continued from page 66*)

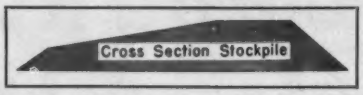
equipment that could push coal economically even greater distances. A demonstration by Michigan Tractor & Machinery Co convinced the utility that the big tractor and the 20-ft U-blade were the equipment needed.

The plant uses the tractor to doze coal to within reach of a reclaiming crane which deposits it onto a yard belt. In emergencies, the tractor dozes the coal directly into an underground hopper leading to the breaker house.

The coal—Western Kentucky, primarily—arrives by lake freighter in shipments averaging 10,000 to 12,000 tons. Coal for use between shipments can be dumped directly on the dock and later transferred to the bunkers by the reclaiming crane. Coal to be stockpiled is dumped into a 1,400-ton hopper and carried by a 60-in. wide transfer conveyor, either directly to mobile coal-handling equipment, or to a 60-in.-wide, 1,200-ft-long yard conveyor.

Carries Up to 1,800 Tons

This conveyor can be adjusted to carry 600, 1,200, or 1,800 tons per hr, depending on the unloading speed of the freighter. The yard conveyor includes a movable stacker which piles the coal in a continuous windrow for later transfer to the stockpile.



COAL STOCKPILE at Cobb Plant is shaped so that summit is near reclaiming crane

When a freighter is unloading, immediate bunker requirements are carried by the yard conveyor directly to the breaker house, then into the plant.

Consumers Power has shaped its stockpile so that the highest point of the pile—35 ft high—is beside the reclaiming crane. From there it slopes to the edges of the pile. The reclaiming crane picks it up and deposits the coal on the yard belt. It is carried to the breaker house, passed through a hammermill that crushes it to a maximum screen size of 1¾ in. and is then carried by a 42-in. conveyor into the plant to be pulverized and blown into the boilers.

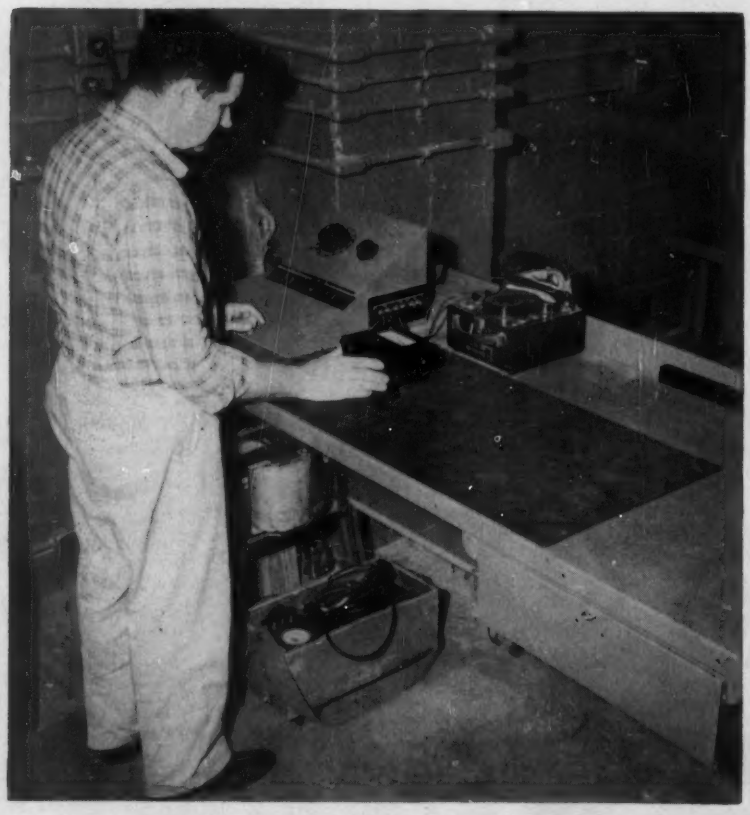
Summer Shipments Heavy

No coal is delivered in winter, the first ship arriving about April 1. Accordingly, the stockpile must be built up by heavy summer shipments.

The plant's equipment stores coal in the summer and reclaims it in winter.

By the close of the navigation season, sufficient coal must be stockpiled to provide a two-month safety factor throughout the winter.

METERING—Testing



Equipment Speeds Voltmeter Tests

An especially equipped test table simplifies and speeds the testing of Houston Lighting & Power Co voltmeters. Most voltmeters used in the field are 150-300-600 v, 0.75% accuracy. About 1,200 are tested each year.

The transformer for testing the meters has a 240-v primary. Secondaries are 10, 20, 40, 80, 160, and 320 v. All windings are No. 10 B&S gage wire. The transformer is accurate to within 0.01% of marked secondary voltage.

When voltmeters are being tested, a standard meter is connected permanently across the 40 and 80-v taps in series. Voltage is adjusted in the primary winding so that the standard meter reads exactly 120 v. The voltage source is held constant by a voltage regulator. Voltmeters with 15 cardinal scale points may then be tested by flipping switches which give full scale of 150 v in steps of 10 v, 300 v in steps of 20v, or 600 v in steps of 40 v. Other ranges may be tested also.

FPE Oil Circuit Breaker Leads are Insulated and Protected with NATVAR Varnished Seamless Bias

This Federal Pacific Electric Type AJ-54 heavy duty oil circuit breaker, 69 kv, 2000 amp, has a 5000,mva interrupting rating. Interrupting time is 5 cycles with 20 cycle reclosing. Natvar seamless bias cut varnished cambric is used to insulate the current transformers located around each bushing, and the leads from the transformers to the operating control mechanism. Natvar 400 extruded vinyl tubing is also used to protect the conductor between the expulsion chamber and the resistors.

The Pacific Switchgear Division of the Federal Pacific Electric Co., San Francisco, now celebrating its 50th anniversary, manufactures oil circuit breakers to provide protection for large high voltage systems so they may keep pace with rapid load growth, and yet retain the advantages of simplified bus schemes and minimum use of current limiting devices.

Both design and materials play an important part in reliability of performance. Natvar flexible insulating materials are used because of their excellent physical and electrical properties—particularly their resistance to oil—and their exceptional uniformity.

Where performance of electrical apparatus and equipment is important, it pays to specify Natvar flexible insulations. They are always of uniformly high quality, whether supplied from your wholesaler's stock or direct from our own.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet, tape, tubing and sleeving
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

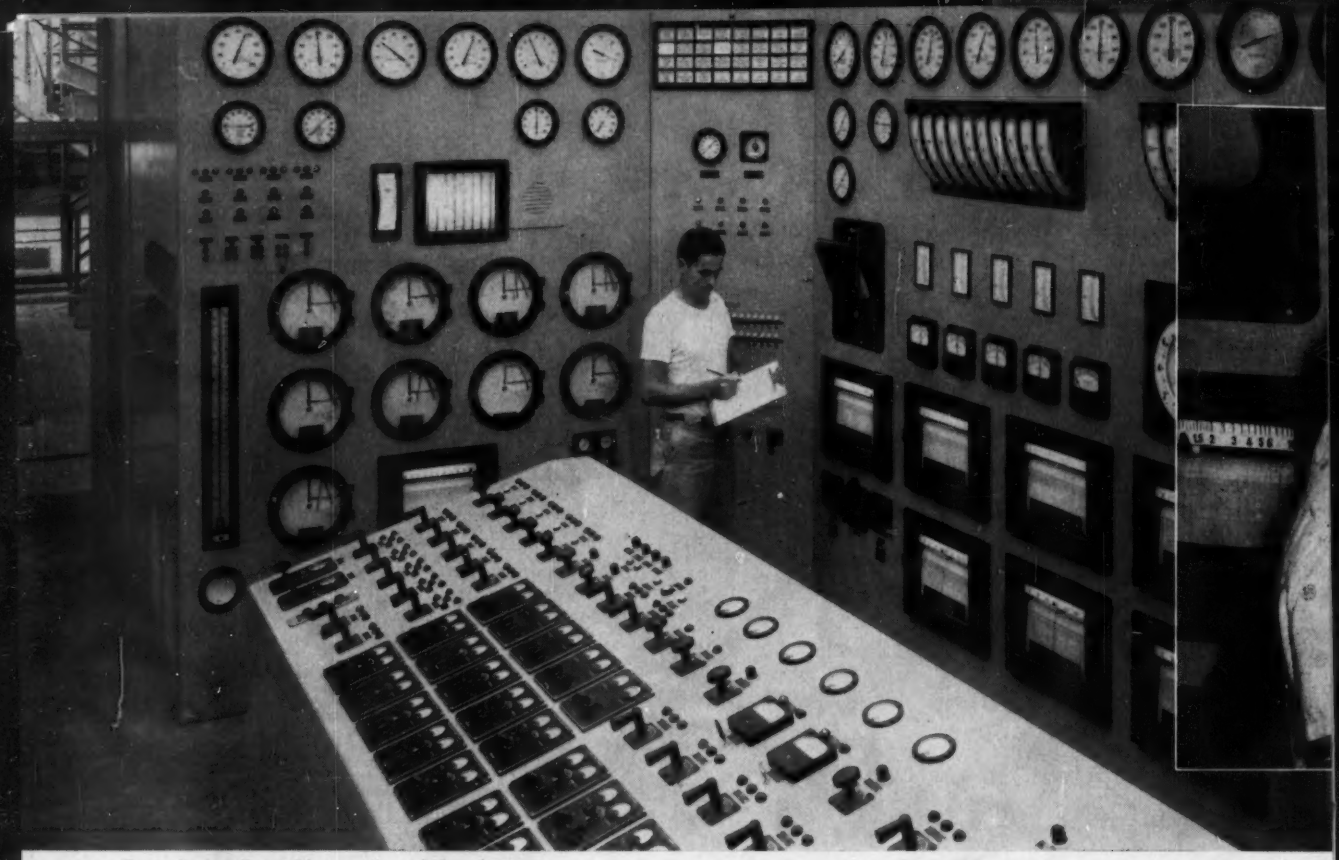
Ask for Catalog No. 23

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

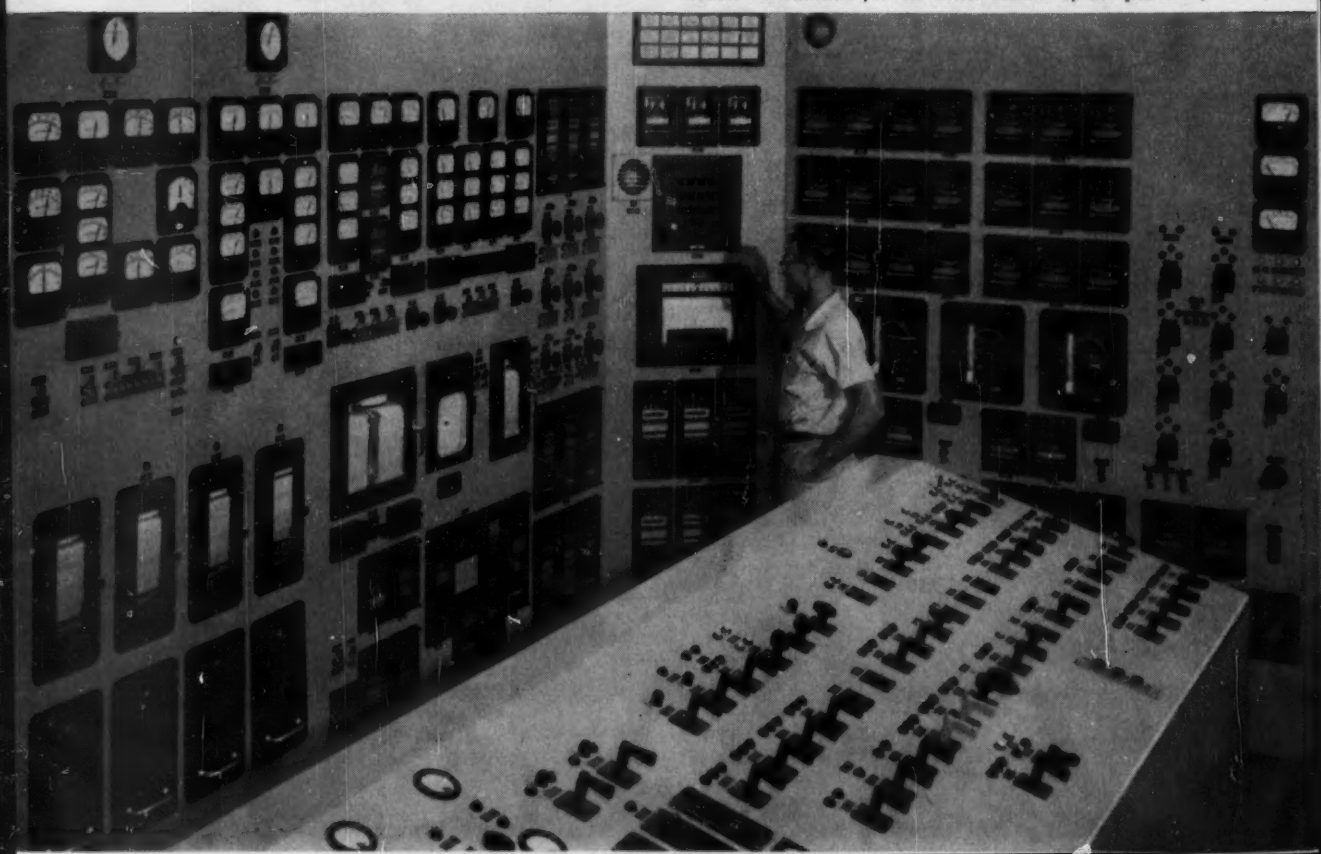
TELEPHONE FULTON 8-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY



Controls for the turbine section of the plant are mounted on this side of the control room. ▲

This side of the central control room at the Gorgas plant houses instruments for the boiler section of the plant. ▼



Honeywell field engineer, left, services an ***ElectroniK*** *strip chart recorder at Alabama Power Company's Gorgas plant, as an Alabama Power engineer looks on.*

Alabama Power Company relies on Honeywell instrumentation and service

Alabama Power Company gains major advantages through use of Honeywell instrumentation at its Gorgas Steam Plant near Birmingham. One of these is dependable, accurate control over both boiler and turbine sections. The Gorgas plant is Alabama Power's first installation to combine instrumentation for both sections in a central control room.

Equally important is the unmatched Honeywell service. Here, as in other installations, field engineers from the local Honeywell branch office provided service assistance at startup. And, should emergencies develop, service from Honeywell usually arrives in less than 24 hours after a call . . . anywhere in the U.S.

You, too, have much to gain from the proved reliability of Honeywell instrumentation and complete service follow-through. Your nearby Honeywell sales engineer will gladly provide full details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

LBE Case History: Potomac Ed Doing Fine

Potomac Edison Co of Hagerstown, Md., was one of the first utilities to get solidly behind the Live Better . . . Electrically program when the idea went out to the industry in 1955. Potomac Ed decided to spearhead it in December of that year, and they've been going solid LBE ever since.

PE's approach, activities, results and expectations provide a good case history and example of what can be done when a utility takes advantage of an industry-wide program such as LBE.

The utility began with a very selective policy. It invited only the leading electrical contractors, dealers and bankers to the February 8th telecast last year that kicked off LBE nationally. Following that, kinescopes of the telecast were shown to all PE employees and to trade allies in the company's 12 districts.

Then the company took another step that shows how well LBE can be tied in with other promotions, even when they're already running. First, the company mounted LBE posters in all its 29 stores. Next, the LBE symbol was run in every PE ad throughout 1956! The symbol was printed on all monthly bills and corresponce; signs were made for all company vehicles, and for all city buses. Employees were given symbols for their cars. *The seal was intergrated with all Housepower materials.* PE's commercial cooking cruiser (see illustration), under the LBE banner, visits roadstands, institutions and restaurants all over the territory.

PE gives out news releases on a regular basis to area newspapers, describing all LBE meetings and major developments. The utility carefully fosters good relationships with them, and makes sure that only newsworthy, well written information is sent to editors. They get generous coverage.

It has designed and built a permanent LBE sign which will be displayed at every company substation. An adequate wiring theme, with LBE integrated, is also planned for 1957.

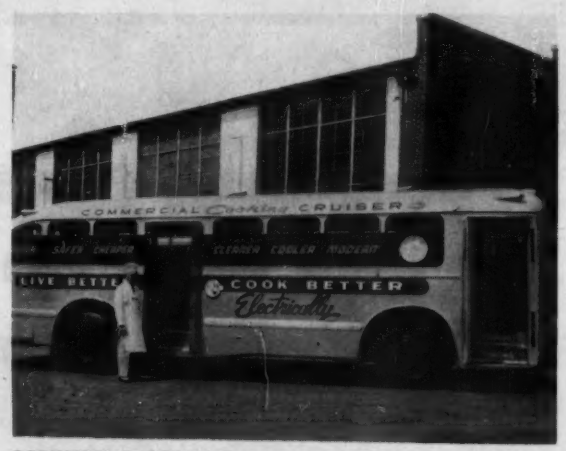
According to E. D. Lyon, PE's promotion manager, "We have tried to introduce LBE into everything promotable by the company, wherever it fits. We view LBE as a long-range, steady activity. . . .

"The key to the whole LBE program's success is consistent follow-through on the local level. The longer the program runs, the more interest and sales will be generated. . . . We've already noted extreme enthusiasm among dealers in our area for this program."

Potomac Edison's 1956 LBE activities and 1957 plans bear witness to the following: (1) LBE can be thoroughly (and profitably!) worked in other programs, and (2) it can serve as a unifying theme for other special efforts and promotions.

(*More Selling on page* 78)

DISCUSSING a new LBE counter poster are l to r, Phil O'Connell and E. D. Lyon of Potomac Ed, and R. C. Hass, Live Better . . . Electrically regional manager



COMMERCIAL COOKING aspects of LBE program are not overlooked by PE. This is its Commercial Cooking Cruiser

STORE WINDOW is decorated with LBE signs. Another example of PE and dealer promotion on the local level

For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC

ELASTIC—
MOLDS TO SHAPE

RESISTS
SUNLIGHT
AND WEATHER

STICKS ON—
STAYS ON

NEAT, THIN
WRAPPING
FULLY
INSULATES

CELLOPHANE
PROTECTED

TRADE MARK JENKINS SINCE 1864 Jenkins Bros.

BEST BUY FOR PLANT SUPPLY

All types of **GOLD SEAL TAPE** — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls.
Every roll cellophane-protected, stays fresh.
Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

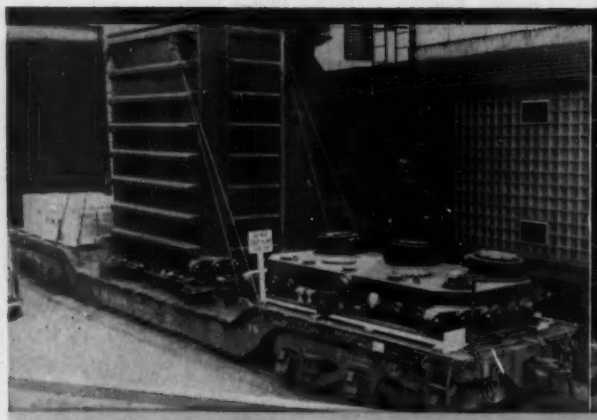
DIAMOND SEAL
Friction and Rubber Tapes
are also made by Jenkins Bros. to ASTM Specifications.

DEFIES WATER,
OIL, SOLVENTS

ADVANCED ENGINEERING DESIGN . . . Wagner engineers, specialists in transformer design, have the skill and experience to design the best possible transformers today—and even better ones tomorrow. This knowledge is incorporated in every special transformer design and in Wagner standardized units as outlined in ASA Standards C57.12b.

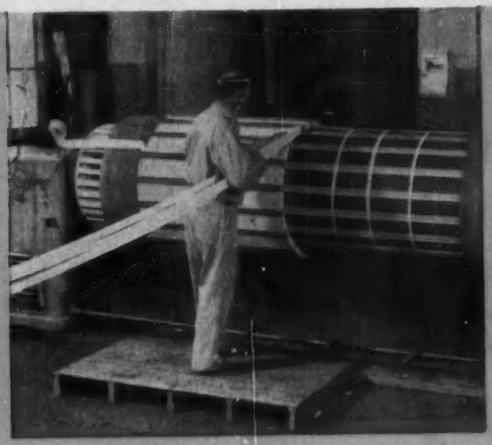
WELL CONSTRUCTED TANKS . . . Wagner builds all tanks for its transformers. Huge brake presses bend the steel plate smoothly. All seams are uniformly welded by the submerged arc method to insure continuous leak-proof welds that mean longer-lasting transformers.

Quality is what you get in Wagner Power Transformers



SPECIALLY EXPEDITED SHIPPING... Railroad cars are brought right into Wagner's power transformer bay for loading. Main line railroads pass the Wagner plant for expedited shipments to all parts of the country.

FIELD INSTALLATION SERVICE . . . Wagner field service trucks, manned by trained service engineers, are available, at nominal cost, to help install new transformers, or to make repairs when necessary . . . another reason why it pays to specify Wagner.



CAREFULLY WOUND COILS... Low voltage helical coils are continuously wound on insulating cylinders of high dielectric strength. High voltage coils are wound with buffer coils at each end for protection against any surges that might be encountered on a properly built transmission line or a substation.

EXACTINGLY BUILT CORES

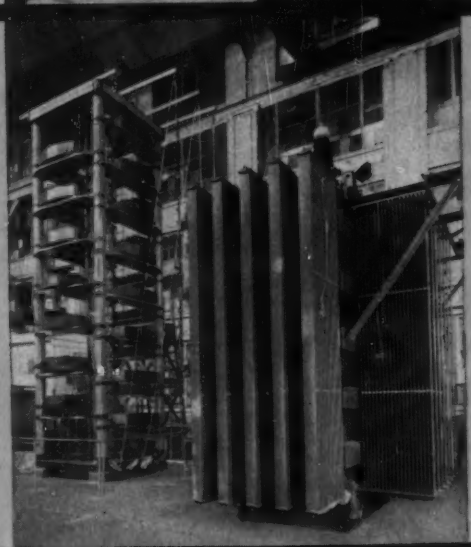
The electrical steel sheets used for core laminations must meet the most rigid specifications. Laminations are annealed at carefully controlled temperatures to assure low core loss. Core laminations, with oil duct spacers, are individually stacked over insulated bolts.

EXPERT ASSEMBLY

Core and coil assemblies are carefully insulated. All moisture and trapped air that might cause hot spots is removed in special vacuum tanks. Extreme care and skill is exercised in every assembly step.

RIGID INSPECTION AND TESTING

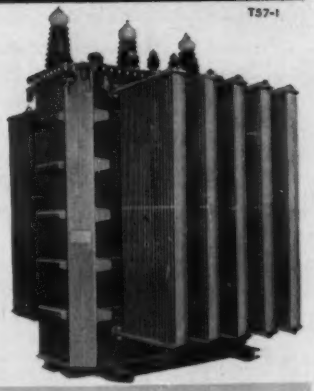
Wagner transformers are given all prescribed commercial tests ...and every new design is subjected to impulse tests to assure that the transformer will perform as designed.



TS7-1

That's why it's to your advantage to specify Wagner

The extreme care given Wagner Power Transformers—from inception to installation—has one objective . . . to build the best possible transformers that will give you years of completely dependable service. Consult Wagner about your next power transformer installation. Thirty-two branch offices are at your service. Write for Wagner Bulletins TU-181 and TU-16D.



Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U. S. A.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

HEATING AND COOLING ELECTRICALLY

Predict A. C. Sales Rise in '57

Wampler sees retail sales volume hitting $3½ billion. Residential, industrial, office installations all to go up

Home, commercial and industrial air conditioning retail sales in 1957 are expected to hit an unprecedented $3½ billion, according to Cloud Wampler, board chairman of Carrier Corp, in a year-end review. This is a 9.4% gain over 1956.

Wampler further predicted a further increase to a $5 billion level in 1961, five years hence. 1956 volume is just under $3.2 billion.

There are three major areas of air conditioning growth:

1. Central air conditioning of residences are expected to increase from 175,000 systems worth $262,500,000 at retail installed in 1956 to 250,000 at $375,000,000 during 1957. By 1961 these figures, respectively, should be 600,000 and $900,000,000.

2. Air conditioning of existing buildings—which for many years has been the largest single source of "big" air conditioning contracts—hit a high in 1956. This market is just beginning to open up in a number of cities, and should grow.

3. Air conditioning of industrial plants showed a spectacular climb in '56. This trend is expected to continue upward.

Automation will also enter into the picture. Factories are installing more and more heat-producing automatic control equipment. Greater employee efficiency demands that this heat be carried off, and air conditioning is the answer.

Wampler also predicted gains across the board in air conditioning sales. Residential and industrial heat pump installations in 1957 will go 10,000; by 1961, 30,000 units will be put in annually.

Room air conditioner sales should climb to 1,600,000 units in 1957 and 2,150,000 by 1961.

With respect to existing office buildings, owners are discovering that they must go to air conditioning in order to keep tenants who will otherwise go to new buildings with integral air conditioning systems. Of particular importance to owners are systems which permits individual control of different areas.

A breakdown of air conditioning sales for 1957: room air conditioners, $440 million; self-contained equipment, $238 million; residential systems, $375 million; applied or "built-up" systems, $1,190 million; heating installations adaptable to air conditioning, $650 million; all others, $600 million, total, approximately $3½ billion.

The comparable picture for 1956 was: room air conditioners, $426 million; self contained equipment $215 million; residential systems, $262 million; applied systems, $1,048 million; heating equipment adaptable to air conditioning, $638 million; all others, $575 million; total, approximately $3.2 billion.

COMPETITOR'S CORNER

Gas Air Conditioning Coming

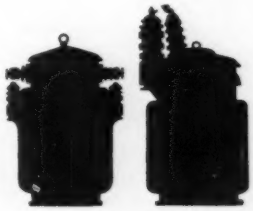
Gas company executives were told recently that gas air conditioning is here and the mass market is just around the corner. At a recent American Gas Association convention in Atlantic city, Leon Ourusoff of Washington (D. C.) Gas Light Co, and chairman of AGA's Task Group for Air Conditioning declared: "Gas already dominates in cooking, water heating and space heating, and the time has now arrived when, to mark further progress, gas must dominate in year 'round air conditioning as well. . . . "

And George Taubeneck, editor and publisher of Air Conditioning and Refrigeration news, told the gas men to forget about the future and start building now. If they wait for better equipment development, or anything else, they'll lose the market to the electrical people.

TWO NEW LINES OF WESTINGHOUSE TRANSFORMERS NOW GIVE YOU

Unprecedented 20% increase in overload capacity . . . without sacrifice of service life

. . . proved by a revolutionary new concept of accelerated life testing which telescopes 30 years' service into 3. Here they are: (left) new, Type S conventional transformer with higher overload capability and optional, new thermal-duty indicator; (right) new CSP® transformer with higher breaker trip settings. These new tools for more effective load management will increase return on your distribution investment.



THE COMPLETE NEW LINES OF WESTINGHOUSE TRANSFORMERS . . .

Now up to 13″ shorter, 33% lighter without sacrifice in thermal capacity; mean substantial change-out savings in premium pole space

WALL MOUNTED TRANSFORMERS 2400 and 4800 VOLTS

25 kva: Old—44″, 505 lbs.
New CSP—35″, 471 lbs.
New Type S—35″, 455 lbs.

37½ kva: Old—46″, 731 lbs.
New CSP—43″, 658 lbs.
New Type S—43″, 635 lbs.

50 kva: Old—46″, 846 lbs.
New CSP—43″, 755 lbs.
New Type S—43″, 740 lbs.

COVER MOUNTED TRANSFORMERS 7200 and 7620 VOLTS

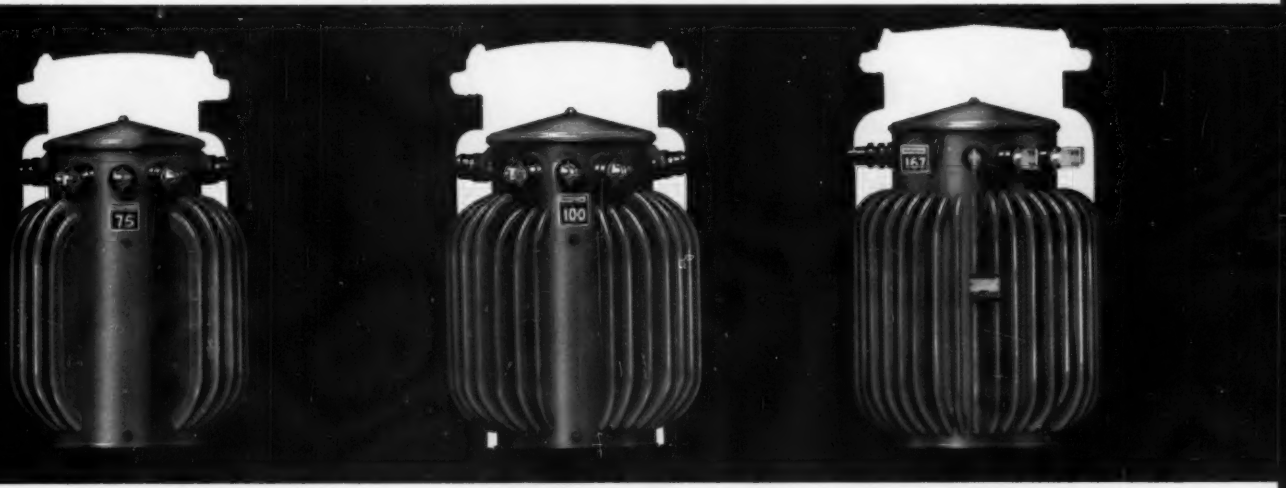
25 kva: Old—48″, 521 lbs.
New CSP—41″, 497 lbs.
New Type S—41″, 475 lbs.

37½ kva: Old—50″, 765 lbs.
New CSP—48″, 705 lbs.
New Type S—48″, 680 lbs.

50 kva: Old—50″, 831 lbs.
New CSP—48″, 760 lbs.
New Type S—48″, 730 lbs.

WATCH WESTINGHOUSE

Here's a way to save on both installation time and equipment costs. Transformers of the next greater kva size can now be mounted in the same space without relocating secondaries. Make replacements, immediate or future, on the same pole—a real advantage where joint pole use is a practice. New installations require smaller poles. Specify Westinghouse, the only complete line of cover and wall-mounted bushing transformers with sweeping reductions in heights and weights.



75 kva: Old—52", 1180 lbs.
New CSP—44", 985 lbs.
New Type S—44", 960 lbs.

100 kva: Old—52", 1395 lbs.
New CSP—46", 1160 lbs.
New Type S—46", 1120 lbs.

167 kva: Old—58", 2010 lbs.
New Type S—48", 1490 lbs.

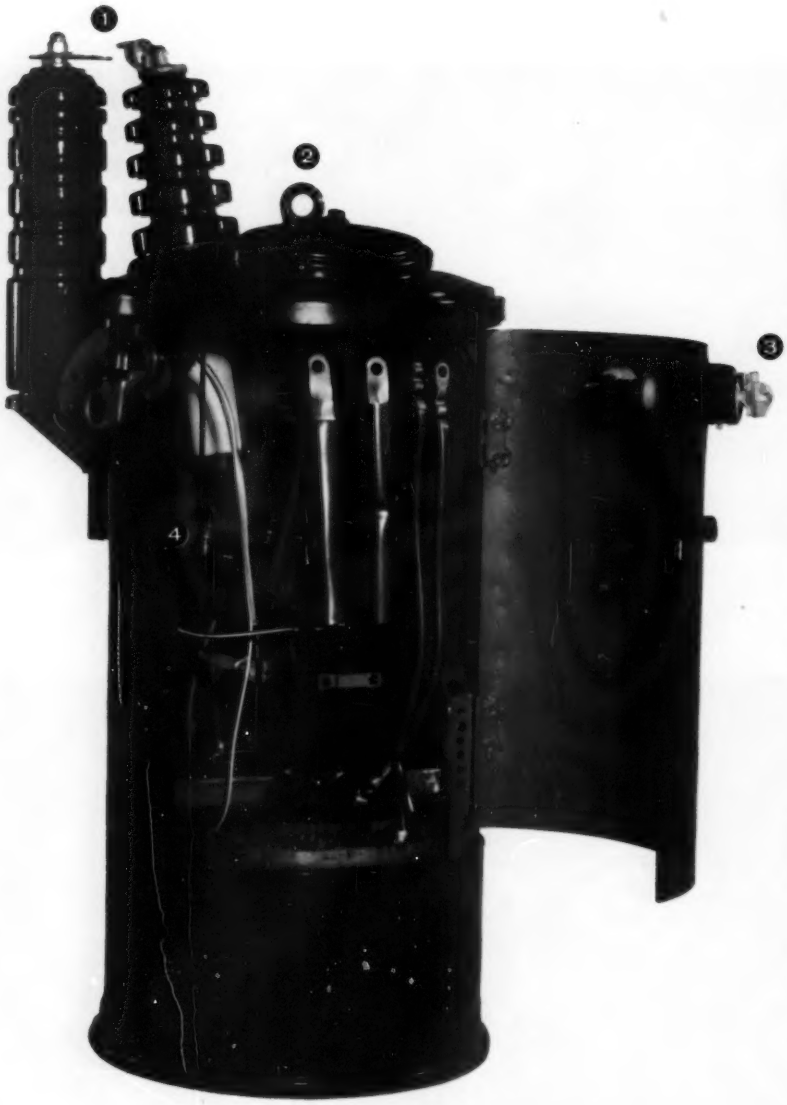
75 kva: Old—56", 1210 lbs.
New CSP—50", 1010 lbs.
New Type S—50", 975 lbs.

100 kva: Old—56", 1420 lbs.
New CSP—54", 1270 lbs.
New Type S—54", 1230 lbs.

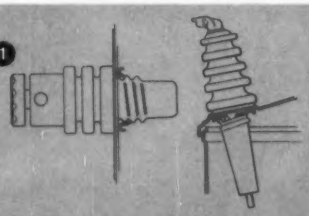
167 kva: Old—64", 2240 lbs.
New Type S—51", 1515 lbs.

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

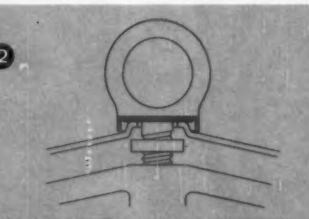
Six new exclusive ideas simplify operating problems



NEW THERMAL-DUTY INDICATOR . . . simplifies overload monitoring. Optional on Type S (conventional), it records total overload hours for the life of the transformer.

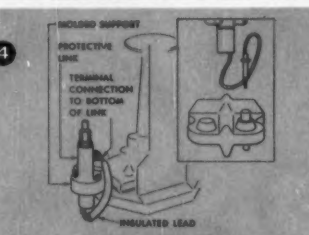


NEW THREADED HV BUSHINGS . . . simplify maintenance. Spring-grip nut, internally mounted, improves bushing seal.

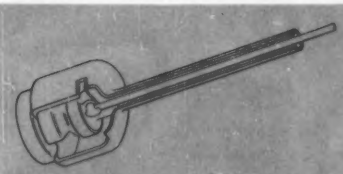


CONVENIENT LIFTING EYEBOLT . . . (3-50 kva) eliminates slings, chains, cable; saves time in mounting transformers. Every unit pull-tested at twice its own weight.

NEW LV TERMINALS . . . take both Al and Cu conductors. Larger terminal with captive bolt has contact area increased 25%, lowers resistance.



NEW PROTECTIVE LINK CHANGE-OUT . . . turns former major repair to simple, routine maintenance on all CSP® transformers, wall- or cover-mounted.

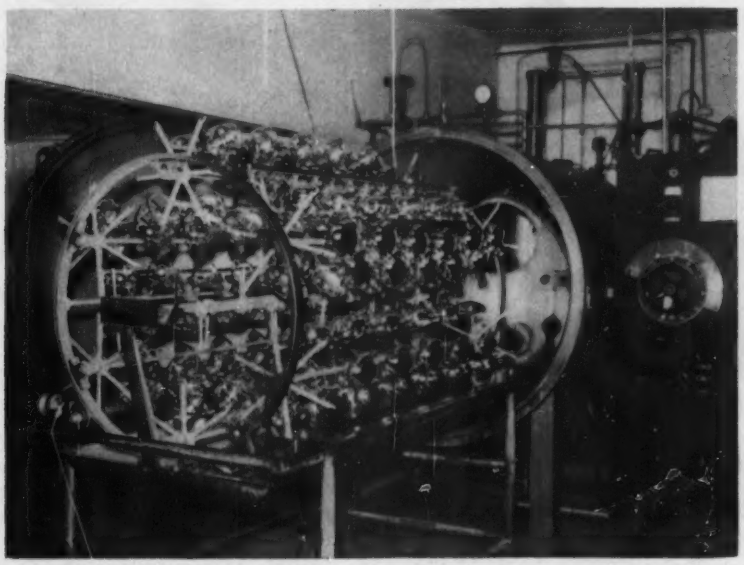


NEW PLASTIC BIRD GUARD . . . prevents line lockout caused by birds or squirrels. Optional equipment, it snaps easily over cover-mounted hv bushing.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

J-70780
Litho in U.S.A.



REFLECTORS ARE LOADED into plating tank. Tank is then evacuated and aluminum vaporized. Random, high speed molecules coat all plastic surfaces

"Vacuum Tube" Plates Plastic

Spotlight reflectors get corrosion proof aluminum coating with mass production vacuum technique

J. H. TARBELL, Industrial Engineer, Kansas City Power & Light Co., Kansas City, Mo.

A new vacuum plating technique is now being used to aluminum plate plastic spotlight reflectors at the Northeast Tool & Die Works, Kansas City, Mo. The new process produces an intensely bright, highly resistant, silvery finish and can be used with equal ease on wood, paper, metal, glass and a variety of other subjects. Production rates run as high as 24,000 parts in an eight-hour day.

Pressure Cut to 0.5 Microns

The plastic reflectors are hung in rows on a large tubular rack, with coils of tungsten filament strung between each row. Aluminum staples are then hung along the tungsten filament and the loaded rack is wheeled into a vacuum chamber. The chamber is hermetically sealed and evacuated by a 7½-hp pump until a pressure of 0.5 microns is reached inside.

During the pumping operation, a current is passed through the tungsten wire to preheat the aluminum staples. At approximately 1,200 F the aluminum melts and spreads over the tungsten filament. When the temperature reaches 1,800F, the aluminum evaporates. Molecules of aluminum vapor are hurled against all the exposed surfaces of the reflectors. The coating is claimed to be equal or superior to any other method. Heating requirements are 15 kw.

After the reflectors have cooled, they are given a coat of protective laquer. A baking operation completes the process, and produces finishes which can resist long periods of exposure to salt spray. A master control panel, located near the vacuum tank, holds all the controls necessary to evacuate the chamber and carry out the plating operation. A single operator can handle the entire process with ease.

INDUSTRIAL NEWS NOTES

Automatic Cigarette Factory

A new, highly automated cigarette factory which can produce 100 million cigarettes in an eight-hour shift was recently put in operation by the P. Lorillard Co at Greensboro, N. C. In the completely air-conditioned plant tobacco moves from the hogshead to the finished cigarette without being touched by human hands. Including a seven laboratory quality control and research center, the new plant has 600,000 sq ft of floor space.

FM Intercom for Steel Mill

An FM carrier system for communication between crane cabs, the soaking pits, and the blooming mill has been installed at the Sheffield Steel Div of the Armco Steel Corp, Kansas City, Mo. Transmitted over existing electrical circuits, the FM equipment requires no special wiring or licenses but has a range of about one mile. Eliminating the interference and misunderstandings of hand and whistle signals, the new system speeds up production with greater safety and efficiency.

Lowers Costs, Boosts Output

Brazing with electronic type induction heaters has lowered costs and increased production at the Lake Tool Division of Besly-Welles Corp, Crystal Lake, Ill., according to GE.

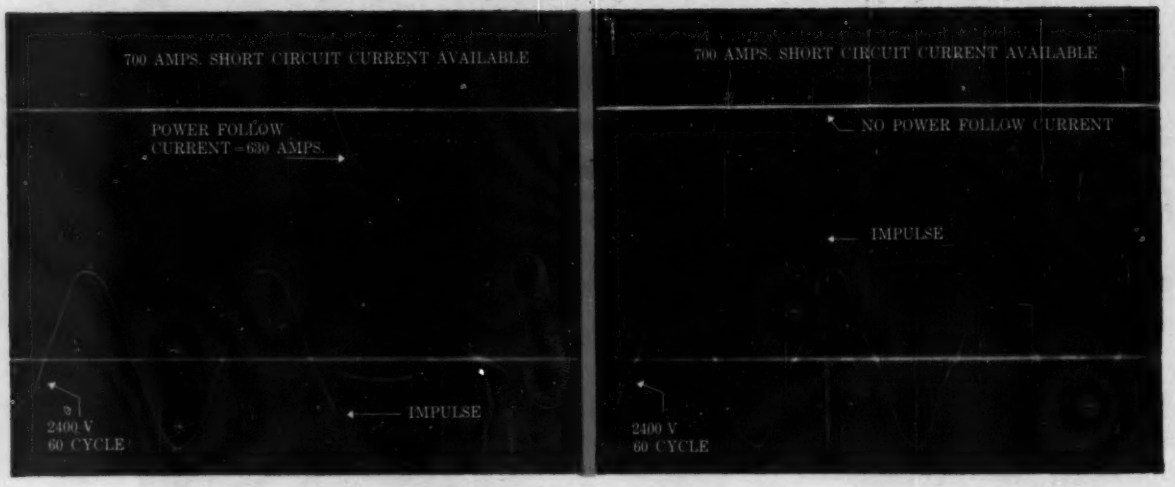
Direct savings thus far from use of a 5-kw heater, said a company spokesman, have amounted to 20% in brazing costs and 20% in diamond wheel cost. It has enabled the company to keep pace easily with its scheduled monthly production.

Automatic Infrared Drying Oven

A new automatic, radiant oven at Allis-Chalmers' Harvey, Ill., plant has cut drying time for spray painted tractors and lift trucks by 98%, company officials report. The old, air drying method took 8 to 10 hours; with the new, accurately controlled infrared over, the trucks are ready for delivery ten minutes after being sprayed. The 100-kw oven, equipped with G-30 lamps, is 18 ft long and is automatically timed.

on the

AUTOGAP PROTECTS WITHOUT POWER


700 AMPS. SHORT CIRCUIT CURRENT AVAILABLE
POWER FOLLOW CURRENT = 630 AMPS.
IMPULSE
2400 V 60 CYCLE
700 AMPS. SHORT CIRCUIT CURRENT AVAILABLE
NO POWER FOLLOW CURRENT
IMPULSE
2400 V 60 CYCLE

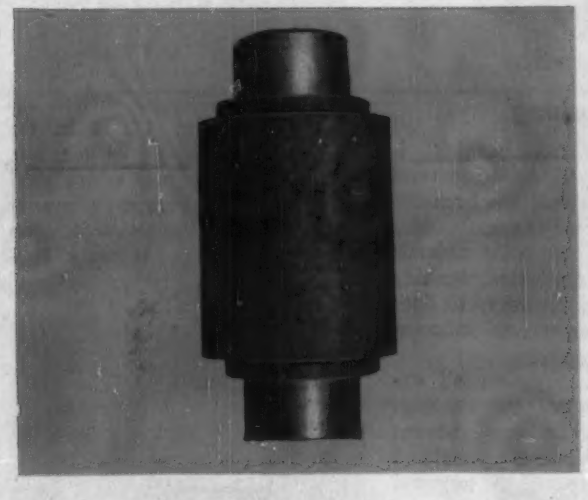
DUTY CYCLE TEST!

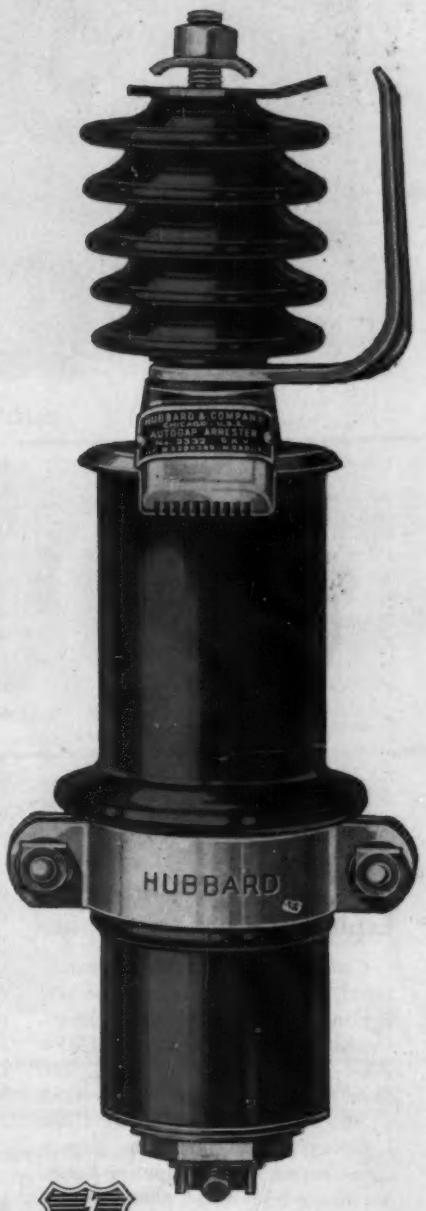
Conventional Arrester—Under the operating conditions shown on the oscillogram, a 3KV conventional expulsion type arrester duty cycle required 630 amps of arrester power follow current. This additional current generally results in large volumes of expulsion gases, which represent consumed fibre from the expulsion tube. Repeated operations show "tracking" over approximately the same discharge path on each operation with consequent deterioration of the expulsion tube and loss of effectiveness.

Hubbard Autogap—The same impulse current and its effect on a 3KV Autogap. Note that the Autogap conducted surge current only. The exclusive barrier plug develops sufficient deionizing gas pressure from the lightning current alone to operate the Autogap. Autogap has a lightning capacity 150% of standard minimum requirements, negligible discharge voltage for any lightning current. There is no deterioration because there is no tracking. An infinite number of discharge paths are offered.

line...

FOLLOW CURRENT!





No deterioration after thirteen years!

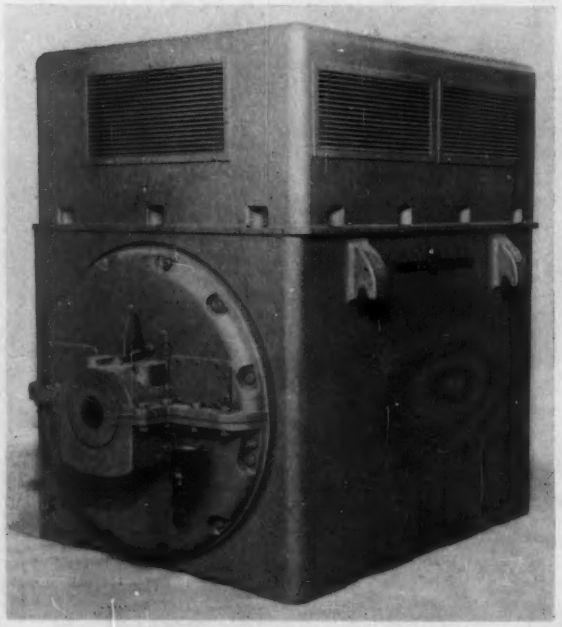
This unretouched photograph of a fibre barrier plug and electrodes was taken after thirteen years of "on the line" service. The 6KV Autogap Barrier plug shows nine *separate* discharge traceries from natural lightning.

While ordinary arresters discharge through the same path each time, lightning discharges around the edges of the Autogap barrier plug, resulting in an infinite number of different discharge paths.

HUBBARD AND COMPANY

6301 Butler Street, Pittsburgh 1, Penna.

From 5 basic models you get 10 standard relays



Boiler Feed Pump Motor

This 3,600-rpm boiler feed pump motor has been specially designed for personnel comfort. Its new design results in a sharp reduction in operating noise, according to GE engineers. High frequency sound levels are reduced by sound-absorbing material and baffles, while low frequency sound is quieted through a stiffening of the stator frames.

Developed by GE's Medium Induction Motor Dept, the design is available in 1,000-hp ratings and up.

It reportedly includes features for reduced maintenance, easy inspection and long motor life. Some of these are: a removable "top hat" section and covers for inspection; feeler gage openings at 90-deg intervals to measure air gap; an air-pressure bearing sealing system; forged steel shaft and non-magnetic steel support rings, strengthened tie-blocks and wedges; and special noise traps inside the cover to reduce magnetic noise.

General Electric Co, Schenectady 5, N. Y.

Explosion-Proof Lamp

Crouse-Hinds has this explosion-proof, portable hand lamp for safe lighting in flammable atmospheres. Designated EVH70, it uses 150-w PAR-38 reflector-type spot and flood lamps and weighs less than 11 lb. It is UL-approved for Class I, Group C or D locations. Has a cone-shaped, heat-dissipating-finned aluminum body and a plastic-coated fiber handle. The terminal housing encloses three pressure connector terminals.

Crouse-Hinds Co, Syracuse, N. Y.

Insulated Bushing

A fully-insulated bushing is now standard equipment on several L-M transformers. It has been designed to eliminate outages caused by pets, birds, and wild animals contacting the transformer bushing terminals. Increased safety to linemen is reported as an inherent feature.

A phenolic cap covers all exposed live parts of the bushing. The cap has a drain to prevent water accumulation. An insulated knob is used to operate the terminal connector. A neoprene sleeve can be used on the high voltage riser to complete the insulation. All L-M Round Wound, single-phase, pole-mounted transformers rated 5 kv or more, up to 167 kva, and three-phase transformers up to 150 kva are equipped with the bushing.

Line Material Co, Milwaukee 1, Wis.

Master Disconnect Panel

A master disconnect panel has been designed to meet the increasing demand for more appliance circuits on residential service entrance equipment. Listed in the manufacturer's catalog as item No. 1122-08, it is for use where local electrical codes require a master or over-all disconnect switch on residential services. It has a 100-

amp master pull-out switch which controls eight single-pole, plug-fuse branch circuits, plus two 60-amp and two 30-amp two-fuse branch pull-out switches. Available with surface or flush trims, the unit measures 18 in. high by 14¼ in. wide by 3⅞ in. deep.

General Switch Co, 45 Roebling Street, Brooklyn 11, N. Y.

(*More New Equipment on page* 88)

position, the front of the bed rests

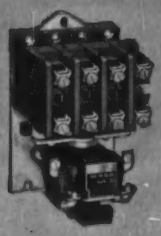
Peschel Electronics Inc, 9 Garden

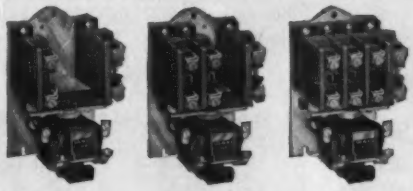
From 5 basic models you get 10 standard relays with the new CLARK Type "PM" Relay line

The 5 Basic Models

SECTIONAL POLE CONSTRUCTION—a new design concept for relays—provides units with 2 to 12 poles, with the greatest variety of combinations and pole arrangements available in an integrated 10-ampere line, and with a minimum of different parts to stock. Extra poles are available in kit form—assembled either normally open or closed. Coils and complete magnet assemblies are also available in kit form. Stocking of coils is simplified since one coil for a given voltage will handle any combination of 2, 3 or 4 poles normally open or closed, and for larger relays is correspondingly simple.

No. 5U-4
Basic
4-Pole

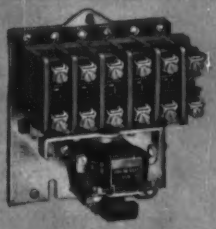


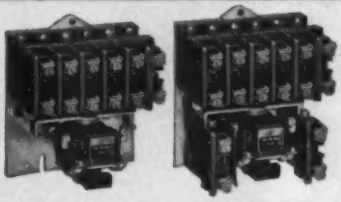


2-POLE 3-POLE 4-POLE

By removing one or two poles, the standard 4-pole unit becomes a 2 or 3-pole relay.

No. 5U-6
Basic
6-Pole

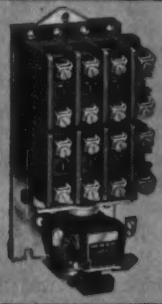


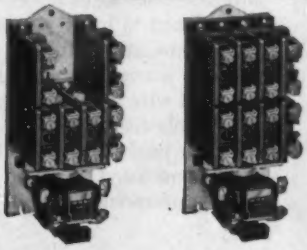


6-POLE 8-POLE

By adding 2 poles next to magnet, the standard 6-pole relay becomes an 8-pole unit —*the first 8-pole relay available for single deck wiring.*

No. 5UK-8
Basic
8-Pole

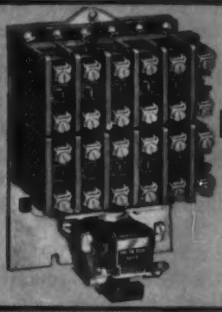


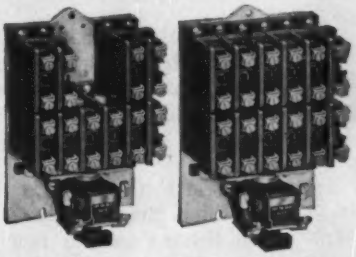


6-POLE Double-decked **8-POLE** Double-decked

By removing 2 poles from the double-decked 8-pole relay, you get an alternate 6-pole of double-deck construction.

No. 5U-12
Basic
12-Pole

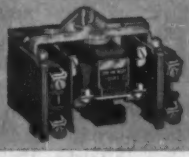




10-POLE 12-POLE

With 2 poles removed, the 12-pole unit becomes the standard 10-pole relay. Both have identical mounting dimensions with NEMA standard size 1 starters.

No. 5UK-2
2-Pole



2-POLE "SPACE SAVER"—a special purpose relay designed exclusively to meet small or unusual space requirements. Overall height less than 3 inches.

Write for 8-page illustrated Bulletin PL-7305 for complete information on this revolutionary new line of heavy-duty relays. Or contact your nearest Clark Distributor.

The **CLARK** **CONTROLLER** *Company*

Everything Under Control

1146 East 152nd Street • • Cleveland 10, Ohio

IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO

Truck-Mounted Crane

A truck-mounted crane, which is said to have wide application in the construction and materials handling fields, reportedly will lift 15 tons at a 10-ft radius with a 30-ft boom. Named Model L-1510, it is mounted on a specially engineered carrier and follows the basic superstructure design of the manufacturer's gas or diesel-electric cranes. Two-line hoisting is facilitated by two drums which may be operated simultaneously or independently, either by power or gravity. The L-1510 is available with boom lengths to 75 ft.
Cole Cranes, Inc, Joliet, Ill.

Portable Coil Cradle

This portable coil cradle can be used for supplying coil stock to presses and other equipment. Called "Koil Kradle," it is equipped with casters; its front wheels swivel for steering. It is available in models capable of carrying from 1,200 to 16,000 lb, and handling coils up to 48 in. wide and 60 in. in diameter.

As its tongue is lowered, the bed is lifted by a cam, clearing the floor by ¼ in. With tongue in a vertical position, the front of the bed rests on the floor.
Benchmaster Mfg Co, Gardena, Calif.

Fence Post Open Curl

This electric fence post for livestock grazing has an open curl covered with a sleeve of vinyl plastisol which acts as its insulator. The red plastic cover is said to insulate safely to 10 kv; the open

curl facilitates installation.

Designed to handle a single wire, the "Tos-Curl" can be equipped with an accessory clip to provide a second wire at any desired height.

The plastisol used for the curl sleeve is based on B. F. Goodrich Co's Geon vinyl resin.
Tosco Enterprises, Akron, Ohio.

More New Products

General Electric Co, Plainfield, Conn., offers a hinged-cover **wireway** for use where space is limited and building contours are complicated.

Edwin F. Guth Co, St. Louis 3, Mo, offers has a **hanger** for fluorescent lighting fixtures that features "micromatic" vertical adjustment up to 1 in.

Quarie Controllers, Canton, Mass., have developed a reportedly new **system-and-process control that** is said to make optimum performance possible regardless of changes in external conditions. It is adaptable to minimizing fuel costs in a furnace, for example.

Peschel Electronics Inc, 9 Garden Street, New Rochelle, N. Y., offer their P-1 **tester** that reportedly counts insulation faults (pinholes) in insulated wire at speeds up to 600 ft per minute.

Tensitron, Inc, Harvard, Mass., has a **tension indicator** that attracts the operator's attention by a flashing light whenever the pre-set tension limits of an industrial process are exceeded.

Licon Switch Division of Illinois Tool works, Chicago 39, Ill., has a **limit switch** with interchangeable components, three actuators, and three housings that may be used to form sixteen types of switches.

Waters Mfg Co, South Sudbury, Mass., has a line of clear plastic-enclosed **panel meters** that reportedly can be read by room lighting without the need of supplementary meter illumination.

White Motor Co, Cleveland 1, Ohio, introduced a complete new line of **highway trucks** in the recent National Auto Show held in New York's Coliseum.

Stonco Electric Products Co, Kenilworth, N. J., has developed a portable **floodlight** that is said to produce 121,500 cp with only a 500-w rating.

International Register Co, Chicago 6, Ill., offers a **time switch,** designated Intermatic Series V22-000, that controls two different electrical circuits at different times.

Hess, Goldsmith & Co., 1400 Broadway, New York 18, N. Y., have developed a **glass insulating tape** that is said to have improved handling qualities, for the electrical industry. It is called "Hesgon."

Lightolier, Inc, Jersey City, N. J., has a group of **modular light "Calculites"** that are said to feature clean, crisp lines and provide a "built-in" look. Each module is approximately 9 in. square.

Hoffman Engineering Corp, Anoka, Minn., are producing eight sizes of 2-door NEMA 12 **panel enclosures** ranging from 54 x 42 x 8 in. to 72 x 60 x 12 in.

"It's Everybody's Family Tree!"

The familiar utility pole might well be considered "part of the family". Through the years it has supported the wires that bring light, warmth, communication and labor-saving energy into every home.

In countless locations, these wires are being supplanted by SIMPLEX SELF-SUPPORTING AERIAL CABLES, which have built an unmatched reputation for efficiency and dependability. For sixty-seven years, Simplex has pioneered in the design, development and manufacture of all types of aerial cables used for both communication and power distribution. The benefits of this specialized experience are yours for the asking. Write for Catalog 1006, which gives detailed information.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

Wire sculpture by Henry Szafarz

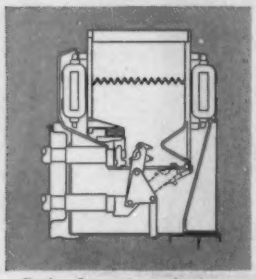
Anhydrex Insulated, Neoprene Jacketed, Self-Supporting Aerial Cable

METAL-CLAD SWITCHGEAR

BETTER PROTECTION AGAINST HIGH CURRENT FAULTS

uniform flux density across whole arc chute

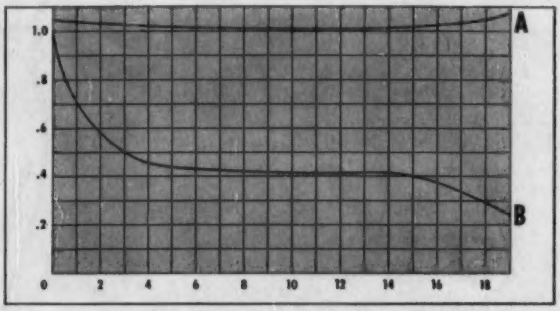
When a high current fault opens an I-T-E 15 kv circuit breaker, the arc is practically swallowed up in the arc chute—faster and over a longer path than has ever before been possible. The reason lies in two unique construction features found only in I-T-E circuit breakers:



Path of arc through chute equipped with twin coils.

1. Twin coils and closed loop magnet. Arc current through the twin blowout coils develops a stronger flux density that is uniform across the entire arc chute. Arc is stretched farther, faster—cooled and extinguished in less time. And the forward part of the arc chute comes into use just as much as the back part. So arc chute life is significantly prolonged.

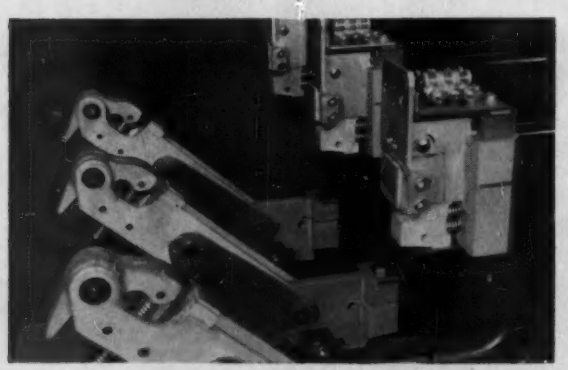
2. Laminated iron of transformer quality. This superior iron construction keeps losses to a minimum. Magnetic field is not only stronger, but rises and falls in phase with the current through the arc. Thus the greatest magnetic pull on the arc occurs when it is most needed—at the top of the current cycles. These are both extra-quality construction features of the sort you can expect to find in I-T-E switchgear. All together,



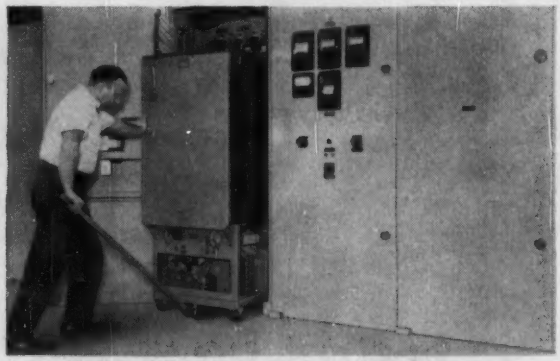
Flux density across entire length of arc chute.
A. Twin coil B. Single coil

I-T-E quality means generally superior performance, better endurance under handling, and longer life in service. Yet it costs you no more.

Get complete information on I-T-E metal-clad switchgear—and the many engineering services available to help you realize greater economy and satisfaction in a system that meets your requirements. Available in ratings from 2.3 through 13.8 kv, 50 through 750 mva interrupting, and up to 3000 amperes continuous. Write to I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.



Fast interruption of low current arcs. As breaker opens, pistons force a jet of air between contact points—driving arc up into arc chute.



Horizontal drawout. Easiest to handle, safest, most convenient assembly known. So strong that switchgear is shipped factory assembled and ready for installation.

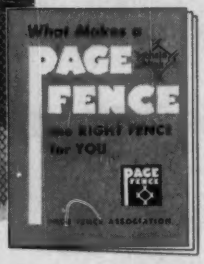
I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division

TWIN COILS
CLOSED MAGNET LOOP
Laminated Iron
of Transformer Quality
I-T-E

PAGE chain link FENCE

America's First Wire Fence—since 1883

Here's how to be sure PAGE Fence will be the RIGHT Fence for YOU



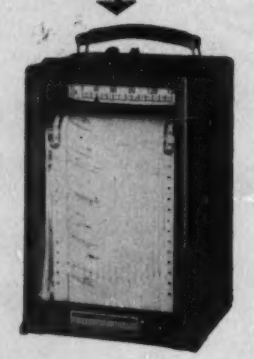
You are invited to write for a file-size folder packed full of information that's essential when making decisions leading to the fence that's BEST FOR YOU. Ask for Folder DH-26.

• When you need a fence it will be much to your advantage to have full knowledge of the many choices of component parts that PAGE provides. You can choose from 8 heights—4 fabric metals—2 types of metal posts—6 styles of gates. All these and other features are pictured and described in the folder offered above. It also supplies facts about the PAGE localized engineering and erecting service that assures highest grade workmanship and lasting satisfaction. Page Fence Association members, located in more than 100 cities, are listed in Folder DH-26. See that list for name of member nearest you.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

FOR LESS THAN 30¢ A DAY



A graphic instrument will tell you what happens to a machine, the output of a department or whole plant, will serve as a continuous inspector of products or processes—

While you are working elsewhere

In no other way can the engineer be in so many places at once. And at a cost of less than 30 cents a day per recorder. You can't afford to be without graphic instruments in your plant. Ask for Bulletin 939A—What You Can Do With a Graphic Wattmeter.

• PRODUCT REPRESENTATIVES IN MOST PRINCIPAL CITIES

The ESTERLINE-ANGUS Company, Inc.

Pioneers in the Manufacture of Graphic Instruments

Dept. D2, P. O. Box 596, INDIANAPOLIS 6, INDIANA

CATALOGS—BULLETINS

• **RESISTORS:** Comprehensive data on the manufacturer's Type BT fixed composition resistors is contained in Bulletin B-1A issued by International Resistance Co, 401 N. Broad St, Philadelphia 8, Pa.

• **STEEL WIRE:** A 120-page Manufacturers Wire Handbook featuring almost 100 types of steel wire is available free from Pittsburg Steel Co, Grant Building, Pittsburg 19, Pa.

• **ANNUNCIATOR SYSTEMS:** Self-policing visual and audible annunciator systems are covered in a new catalog published by Scam Instrument Corp, 1811 W. Irving Park Road, Chicago 13, Ill.

• **WATER SOFTENERS:** A 20-page publication deals with the necessity for water softening, explains the fundamentals of softening, and provides information on the selection of equipment and the manufacturer's zeolites. Cochrane Corp, Philadelphia 32, Pa.

• **POSITIONING CONTROLS:** Bulletin No. J-100 covers electrical remote positioning Controls for push-button and automatic operation that are manufactured by Jordan Co, 3235 W. Hampton Ave, Milwaukee 9, Wis.

• **LIGHTING:** The following publications were issued recently by Sylvania Electric Products, Inc, 1740 Broadway, New York 19, N. Y.:

Very High Output (VHO) Fluorescent Lamps are described in a 4-page brochure.

Light Control for stores and industry is covered in a brochure covering the firm's "built-in" reflector lamps.

Mercury Vapor Lamp booklet entitled "How Mercury Vapor Outdoor Lighting Brings More Night Action", is designed for railroads, transit companies, oil companies, refineries, steel mills, supermarket chains, etc.

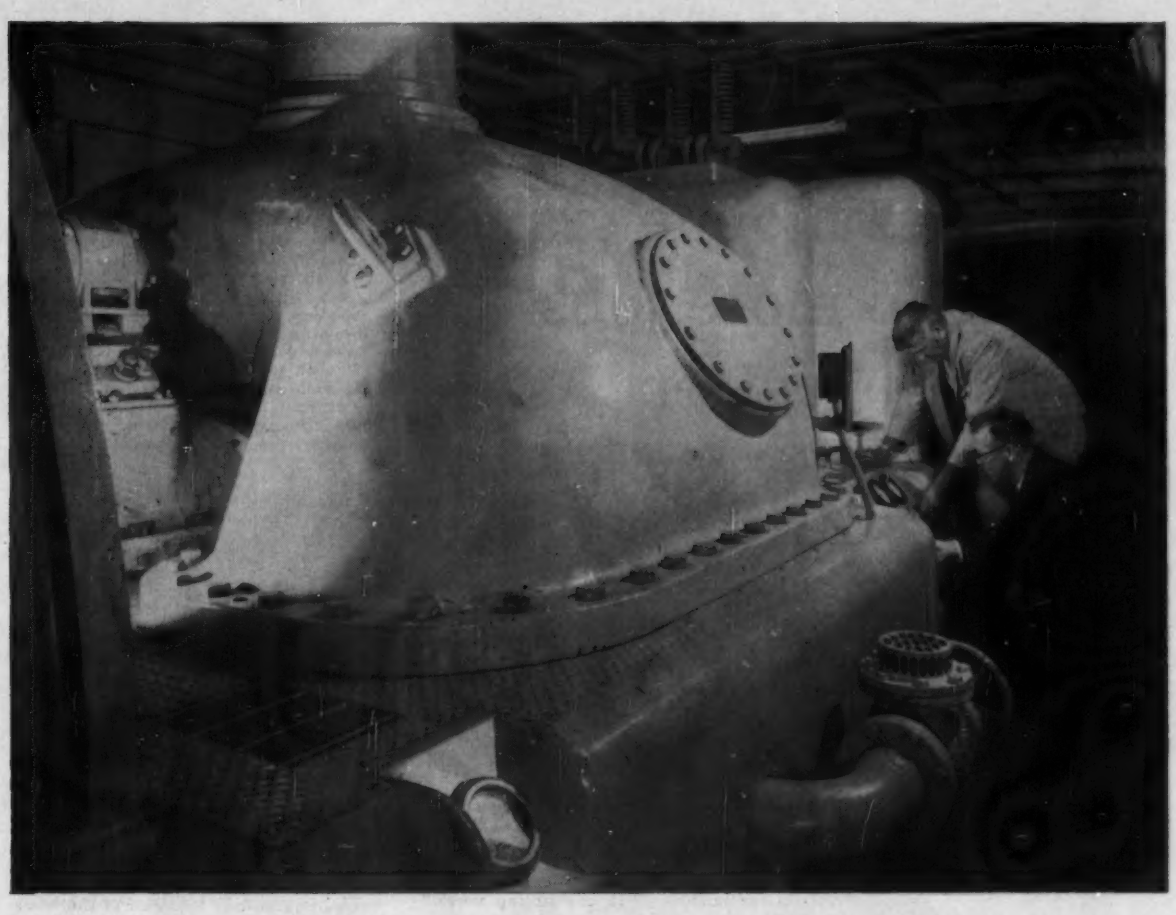
Industrial Lighting Booklet features sections on safety and visibility factors, uses of fluorescent, incandescent and mercury vapor lamps, maintenance, and a condensed catalog of fixtures.

• **MAGNETIC TESTING:** A 15-page pamphlet discusses the "Magnaflux-Magnegio" magnetic particle inspection techniques with a view to allowing users to perform these non-destructive tests more profitably. Free, write Magnaflux Corp, 7300 W. Lawrence Ave, Chicago 31, Ill.

• **FUSE LINKS:** Bulletin FC5, describing L-M's complete line of fuse links, including EEI-NEMA Types "K" and "T", is now available from Line Material Co, Milwaukee 1, Wis.

• **MAGNETIC SHIELDING:** A 32-page brochure entitled Data Sheets 101 (1957), describing construction features, performance characteristics and typical applications of Fernetic and Co-Netic magnetic shielding material has been released by Magnetic Shield Div, Perfection Mica Co, 20 N. Wacker Drive, Chicago 6, Ill.

• **INSULATING TAPES:** "Insulating Tapes & Fabric Parts" is the name of a booklet (NO. B-1050) that lists technical data and applications of the line of electrical insulating materials available from Westinghouse's Micarta Division. Write Westinghouse Electric Corp, Micarta Division, Trafford, Pa.



Albert C. Rickborn, Plant Superintendent at Mississippi Power & Light Company, Jackson, Mississippi, and W. W. Wellington, Gulf Sales Engineer, discuss performance of Gulfcrest in one of this plant's three giant turbines. These units were installed in 1948, 1950, 1951—and Gulfcrest has protected all three from the beginning!

Only GULFCREST is Alchlor-Processed . . . for super performance!

Gulfcrest delivers superior performance—over long periods of time—in every type of steam turbo-generator. This incomparably pure turbine oil is super-refined by Gulf's exclusive Alchlor Process. Unstable hydrocarbons are removed by this process, then special inhibitors are added to increase oxidation stability, prevent foam and protect against corrosion.

Gulfcrest has been in continuous service in several large turbines for over 20 years—without any significant change in its characteristics. And neutralization numbers of the oil remain remarkably low. Gulfcrest offers safe, sure turbine protection for many years . . . an excellent long-range investment!

Your Gulf Sales Engineer will be glad to recommend the proper grade of Gulfcrest for you. Just call your nearest Gulf office.

GULF OIL CORPORATION
GULF REFINING COMPANY
1822 Gulf Building
Pittsburgh 30, Pa.

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

Flexible, fast and safe, Coles mobile cranes can do more jobs better for less

Coles works closer to stacks for accurate spotting maximum SELECTIVITY

COLES
CRANES
JOLIET 6, ILLINOIS

Write for booklet "101 cost-cutting ways."

Photo courtesy Iowa-Illinois Gas & Electric Co.

Now, available L.P.G.- diesel- or gasoline-electric powered in capacities from 2 to 15 tons. Available on long term lease arrangement, too.

TECHNICAL LITERATURE

MISCELLANEOUS—The following publications have been published by the American Institute of Electrical Engineers, 33 West 39th Street, New York 18, N. Y.:

- A 172-page book entitled "Electric Power Distribution for Industrial Plants, 2nd Edition—$3.50 (50% discount to members). AIEE No. 952.
- A booklet, "Grounding of Industrial Power Systems", 40 pages, $1.20 (50% off to AIEE members). AIEE No. 953.
- A 23-page booklet describing the Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound Electric Machinery. AIEE No. 510, 80¢ (50% off to AIEE members).

In addition to the above publications, AIEE has also issued the following manuals for various *proposed* procedures. They are published for trial use and are free:

- AIEE No. 511—Proposed Test Procedure for Evaluation of Systems of Insulating Materials for Electric Machinery Employing Form-Wound Pre-Insulated Coils.
- AIEE No. 62 — Proposed Recommended Guide for Making Dielectric Measurements in the Field.
- AIEE No. 63—Proposed Guide for Maintenance of Insulating Oil.
- AIEE No. 64—Proposed Test Procedure for Thermal Evaluation of Ventilated Dry-Type Power and Distribution Transformers.

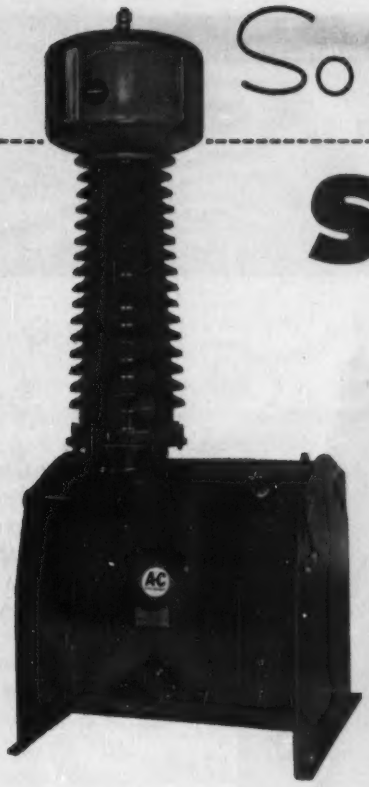
ELECTRONICS MEASUREMENTS—The "Handbook of Electronic Measurements" has been published by the Microwave Research Institute of the Polytechnic Institute of Brooklyn to fill the need for a concise and complete source of information in the electrical engineering field. The 2-volume handbook was edited by Moe Wind, Research Assistant Professor of Electrical Engineering, and was prepared under the sponsorship of the General Engineering Laboratory of the Rome Air Development Center, Griffis Air Force Base, Rome, N. Y. 18 chapters, 600 photographs, 879 pages. Price $15.00 per set. Address Polytechnic Institute of Brooklyn, Microwave Research Institute, 55 Johnson Street, Brooklyn 1, N. Y.

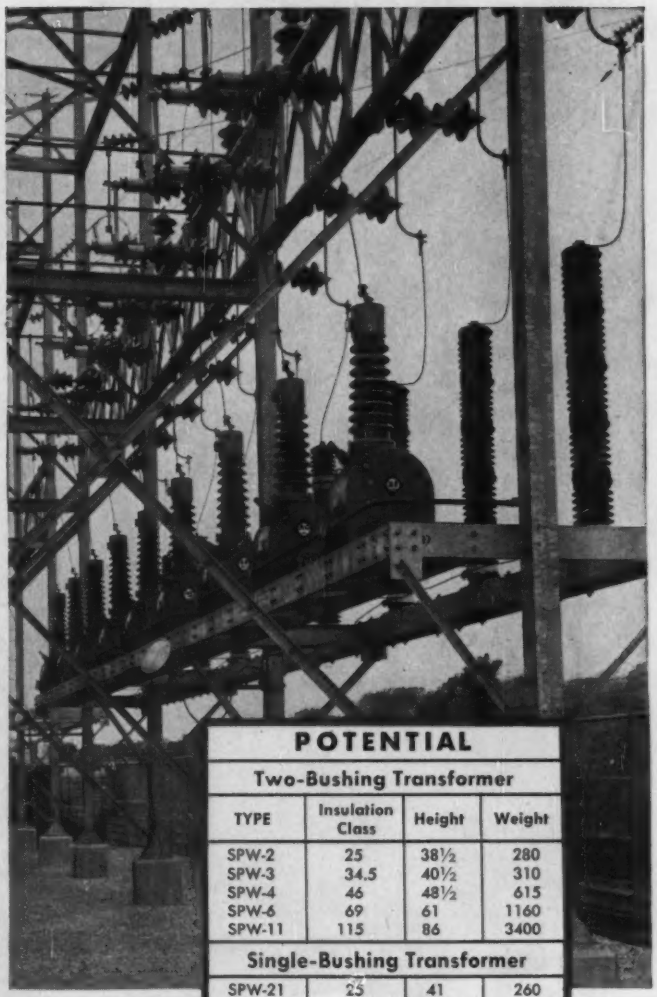
NUCLIDES—More than a hundred new forms of chemical elements, which have been identified in the past three years, are shown on the 5th edition of GE's "Chart of the Nuclides." It was prepared at Knolls Atomic Power Laboratory. The general term "nuclide" covers all the isotopes of all the elements, and derives from the word "nucleus", since it is the nucleus or core of the atom that accounts largely for the difference in atomic weights in the same element, and hence, gives rise to the classifications known as isotopes. Chart is free; write General Electric Co, Schenectady 5, N. Y., Dept 2-119.

BRITISH CONDUCTORS—The new British Standard for Paper-Covered Rectangular Copper Conductors for Transformer Windings (B.S. 2776:1956) has been reported issued. Based on two previous British Standard papers, B.S. 1432 and B.S. 698, the new publication extends the range of B.S. series dealing with covered conductors and specifies material suitable for winding medium-sized power transformers. Copies may be obtained from British Standards Institution, Sales Branch 2, Park Street, London W.1. Price is five shillings (about 75¢).

So Light...SO COMPACT

So *Easy* to Install





MUCH smaller and lighter than previous designs, new Allis-Chalmers potential transformers cut installation costs and provide maximum handling convenience. Less space and less foundation to mounting structure are required. A fork truck or block and tackle is all that is needed to lift these 69-kv units into position. And, of course, relocating is accomplished just as easily.

Performance has also been improved in both ratio and phase angle with the advanced design of Allis-Chalmers potential transformers.

Many other design features — features that assure unparalleled dependability and long life — have been incorporated in these modern units. Get the complete story from your local A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

POTENTIAL

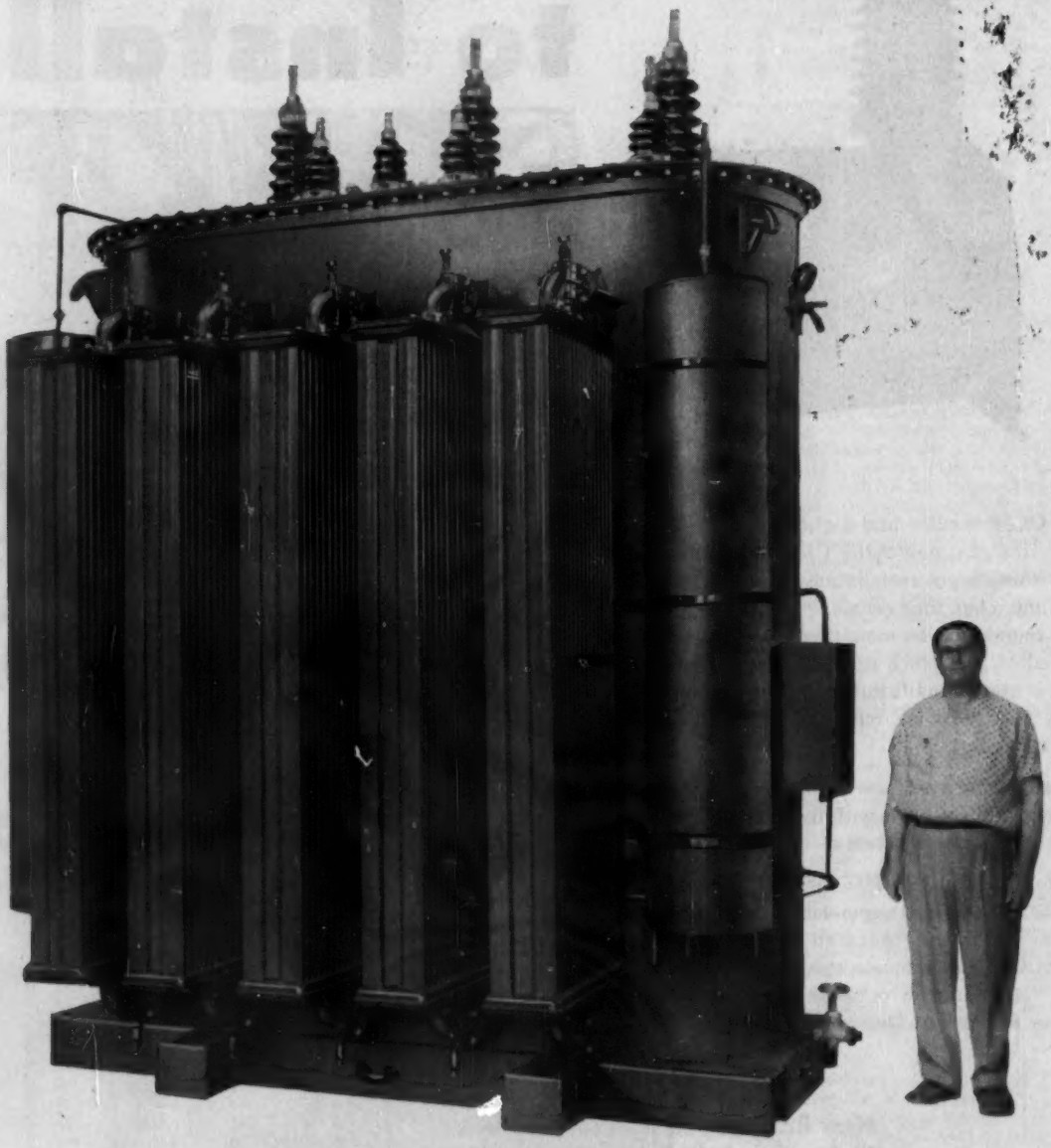
TYPE	Insulation Class	Height	Weight
Two-Bushing Transformer			
SPW-2	25	38½	280
SPW-3	34.5	40½	310
SPW-4	46	48½	615
SPW-6	69	61	1160
SPW-11	115	86	3400
Single-Bushing Transformer			
SPW-21	25	41	260
SPW-31	34.5	44¼	285
SPW-41	46	50¾	460
SPW-61	69	63¾	950
SPW-111	115	92	2310
SPW-131	138	112	3510

New Ratings have been added to the Allis-Chalmers line of potential transformers to include higher voltage insulation classes.

ALLIS-CHALMERS

A-5164

Standard®



SPECIAL CONSTRUCTION in this AT, QISC power transformer was designed to meet the requirements of a Michigan user. The unit is 7500 KVA, three phase, 60 cycle, 66,000 to 13,800 volts. It has gas seal construction, is equipped with lightning arrester mountings, and arranged for addition of forced air cooling. STANDARD engineers will work with you to design the transformers that serve your needs most efficiently.

THE POWER TRANSFORMERS THAT BUILT A REPUTATION...

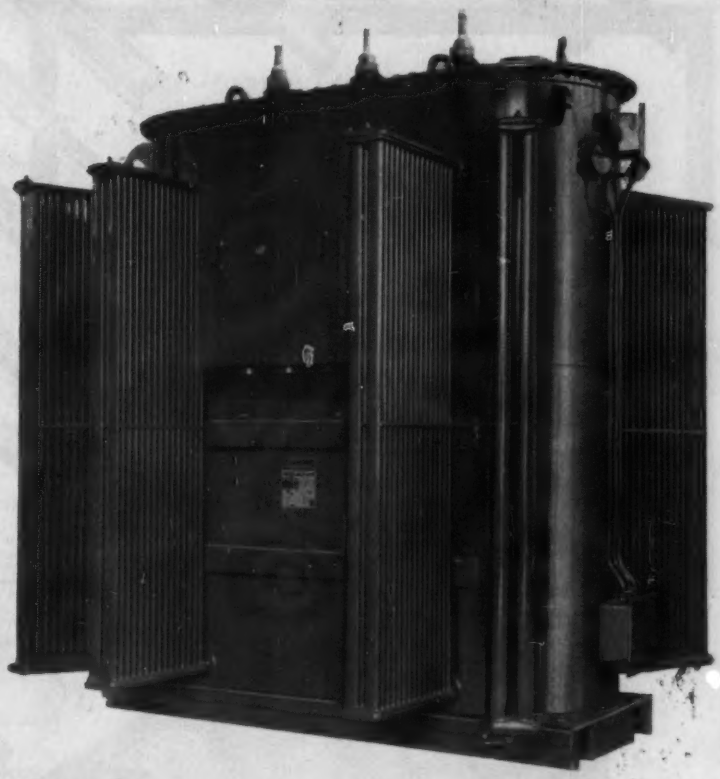
Standard Transformers are the choice wherever power requirements create a need for extra reliability. These units, each designed to provide the maximum in efficiency, incorporate those features chosen by Standard customers.

Power requirements differ, and the transformers needed to meet these can only be met by transformers specifically selected to handle them. Standard customers get these added construction features at no more cost than they'd pay for repetitive models.

Some features are standard at Standard Transformer Company. Insulation exceeds all ASA specifications and gives added protection against flashover. Coils are moisture-proof.

Power sheared laminations minimize short circuits and core loss caused by burrs. Expensive and unnecessary clamps are eliminated in core assemblies. NEMA size connectors, strain tested by mercurous nitrate, are used on all bushings to reduce maintenance time.

Be selfish about your power transformers. You want reliable, uninterrupted service. You want efficient service. You get all of that, and more, when Standard Transformer Company engineers design the power transformers that are designed to serve YOUR needs. There's a Standard representative near you. Contact him today.



7500 KVA, OISC, three phase transformer, 13,200 volts primary, 4160Y/2400 volts secondary. The unit has cover-mounted bushings and low voltage terminal chamber. Unit designed for a Missouri pumping station.

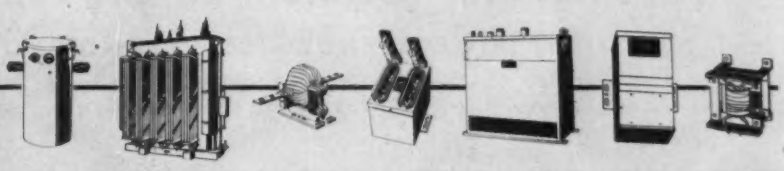
Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

Transformers FOR EVERY APPLICATION



Nicopress Sleeves and Tools Patented in U.S. and Foreign Countries. "Nicopress" Registered in U.S. and Foreign Countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturers Are Optimistic for 1957

Aluminum Company of America

"Our production of primary aluminum rose during 1956 to an all-time high of approximately 750,000 tons, or about 7% above the output for the previous year . . . Will complete smelting facilities . . . to achieve a total installed capacity of 962,000 tons."

I. W. Wilson, President

Anaconda Wire & Cable Company

"With reports of continued construction expenditures —plus expanding electrical utility plans and pent-up demands for automotive and communication requirements—the company looks to the year 1957 to equal or exceed the year 1956."

W. E. Sprackling, Executive Vice President

Copperweld Steel Company

"During 1956, the company attained the highest sales volume in its history, approximately $100 million. Because of the high level of industrial activity, the strong demand for Copperweld products is expected to continue well in 1957."

J. M. Darbaker, President

Federal Pacific Electric Company

". . . shipments climbed approximately 30% during 1956, and we expect them to rise an additional 25 to 30% during 1957. Our high-voltage switchgear backlogs are the highest since Korea war buying."

Robert C. Graves, Vice President-Sales

Kaiser Aluminum & Chemical Corporation

". . . 1956 marked completion of the company's first 10 years as an aluminum producer . . . is in the midst of a major plant expansion program which will substantially increase production and fabricating capacity."

D. A. Rhoades, Vice President

Lapp Insulator Co., Inc.

"There is every reason to believe the demand for high voltage porcelain will be at a high level through 1957 and for years to come. A major problem is to so handle rising costs that a profit will remain large enough to assure continued ability to grow and meet the demands of the industry we serve."

Brent Mills, Executive Vice President

Rome Cable Corporation

"Because forecasts for plant capital and government expenditures, electrical utilities and manufacturing are up, our sales volume should show 5 to 10% increase in 1957. Inventories should decline."

A. D. R. Fraser, President

Sangamo Electric Company

"Total sales should exceed $50 million. Meter business should continue at a high level with increasing sales of polyphase and demand meters. Sangamo power capacitor sales will increase greatly."

C. H. Lanphier, President

Line Material Company

". . . views 1957 business prospects—both for L-M and the electric industry—with optimism. Evidence of our future expectations is our current expansion which includes the construction of a new transformer plant in Visalia, Calif."

R. G. Wheaton, President

Pennsylvania Transformer Company

"New orders for power transformers that will be placed in 1957 will be about 25% above those placed in 1956 . . . distribution transformers, about the same as in 1956 . . . Unfilled orders now approximately 60% greater . . ."

W. R. Swoish, Vice President

Preformed Line Products Company

"As a result of the broadening acceptance of our basic products, and continual introduction of new items, I anticipate 1957 sales volume will be about 35% above the current year."

Thomas F. Peterson, President

S&C Electric Company

"Our prognostications for 1957 are optimistic for the switchgear industry in general. For our company . . . a 10% to 15% increase in sales is projected. This optimism is tinged with caution, however, because of the possible deleterious effect of the current money shortage."

John R. Conrad, President

S. Morgan Smith Company

". . . enters 1957 with one of the largest accumulations of uncompleted contracts in its history. The sales outlook for 1957 continues to be good in both the hydro-electric turbine and valve fields."

B. E. Smith, President

National Electrical Manufacturers Association

"After coming close to the $20 billion mark in 1956 with a record output of $19.6 billion, the industry expects to pass this new level by . . . an over-all increase in shipments of 10% in 1957."

Joseph F. Miller, Managing Director

(*More M & M on page* 100)

CURRENT TRANSFORMER FIELD TEST SET

NEW!

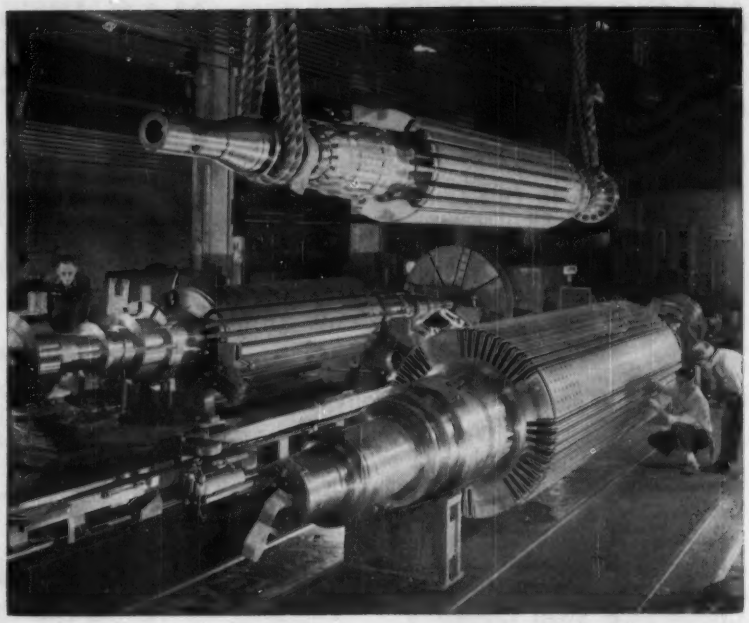
Check your current transformer installation quickly with this NEW TESCO instrument; pinpoint sources of possible trouble in short-circuiting, faulty connections, instrument tampering, and grounding.

A special new feature now available in this instrument is the spread of resistance burdens — .5, 1, 2 or 4 ohms. The lower burden values are recorded for testing the small size low capacity current transformers, which are widely used on low voltage installations.

2½" panel instrument is easily read. Transparent unbreakable plastic cover. Overall dimensions 6⅞" x 5¼" x 3⅛" high. Weight 2¾ pounds.

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

For full information, write for Bulletin No. 54-B



A-C Making 500,000 Kw of Future Power

Nearly 500,000 kw of future electric power are represented in these turbine-generator rotors shown at Allis-Chalmers Mfg Co's West Allis Works.

The 76-ton, 4-pole, 1,800-rpm rotor (on blocks), and its 35-ton, 2-pole, 3,600-rpm partner (hanging from crane) are to form a 300,000-kw, 3,600/1,800-rpm, close-coupled, cross-compound unit which A-C is building for Detroit Edison Co. Another 3,600-rpm rotor is on the lathe. It will go into a 150,000-kw unit for an Indiana utility. Both 3,600-rpm rotors are for fully-supercharged, hydrogen-cooled generators.

I-R to Furnish Condenser, Pumps for Indian Point

Ingersoll-Rand Co, New York, was awarded a $1.3 million contract by Consolidated Edison Co for the main steam condenser and circulating water pumps for the utility's Indian Point nuclear-fueled electric generating station.

The single-pass condenser will have a surface of 212,000 sq ft and, according to Con Ed, will be the largest planned to date on its system. The two pumps will be the vertical wet pit type, each with a 140,000-gpm capacity.

Ajax Firms Combine Efforts

Ajax Engineering Corp., Trenton, N. J., and Ajax Electric Furnace Corp, Philadelphia, Pa., are combining their engineering, manufacturing, and sales efforts. By this coordination they will serve the field of electric line frequency induction melting of ferrous and non-ferrous metals. As of January 1, 1957, all inquiries, orders, and services are being handled from the offices of Ajax Engineering Corp, Trenton 7, N. J.

Westinghouse Announces Developments

Westinghouse Electric Corp, Pittsburgh, Pa., has reported the following items:

• Receipt of contracts totalling $3,300,000 to build major components for three test wind tunnels. One contract, valued at $2,500,000, is for a 16-ft transonic tunnel at Langley Aeronautical Laboratory for the National Advisory Committee for Aeronautics. The other is for

(*Continued on page* 102)

EAST or WEST... you get prompt delivery with

CF&I GALVANIZED STEEL STRAND

Need top-quality three- or seven-wire galvanized steel strand for guy, messenger, or overhead ground wire? Then, no matter what part of America you're in, one of our two modern plants—at Pueblo, Colorado or Buffalo, N. Y.—will quickly and efficiently fill your strand requirements.

What's more, in addition to prompt delivery, you're always sure of the quality of CF&I Galvanized Steel Strand. Every phase of its production is under the CF&I rigid quality control system . . . every phase of its production is supervised by the manufacturers of world-renowned Wickwire Wire Rope and Wire Rope Slings.

When you need strand—to your own or ASTM Specifications A-122 or A-363—it'll pay you to contact your nearby CF&I sales office.

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

4473

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Kansas City Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City San Francisco • Seattle • Spokane • Wichita • CF&I OFFICES IN CANADA: Toronto • Montreal

End cold weather damage to your Gas or Diesel Engines

INSTALL

KIM Hotstart electric pre-heater

QUICK, EASY STARTS

ELIMINATES WARM-UP TIME

REDUCES ENGINE WEAR

KIM HOTSTART plugs into the electric circuit when engines are not in use. It draws cold water from the engine, heats it, then circulates it back through the engine. No need for heated terminals. Engines remain warmed-up; start quickly. You don't use as much fuel and spend less on repair bills. Four KIM models are available. Installation is simple. See your automotive supplier or write for literature.

KIM HOTSTART MANUFACTURING COMPANY

West 917 Broadway, Spokane 1, Washington

Are you missing something in **Electrical World?**

Right now, have a look at the complete, compact, 2-minute summary of the book, printed on special yellow stock at the front. Here is *the gist* of what's going on in the industry! "Newscope" covers future and late news; "Electrical Week" examines events, generation, distribution, commercial, management, people, manufacturing, and new equipment; "Engineering Trends" briefs *that* aspect of issue content. This specially written summary in the front of each issue, on yellow stock for easy finding, gives you *the complete overall picture of the industry and everything affecting it for the past week!* It mirrors the contents of each issue for absorption almost at a glance – let's you invest your Electrical World reading time more profitably.

If . . .

YOU CHANGE YOUR ADDRESS

Be sure to notify us so that future copies of ELECTRICAL WORLD will be delivered promptly.

Also make certain you advise your local Postmaster so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

Send your new and old address to:

Subscription Dept.

ELECTRICAL WORLD

330 W. 42nd St.

New York 36, N. Y.

(*Continued from page* 100)

$8,000,000 for two wind tunnels for Martin Co of Baltimore.

• An order to supply 1,300 special 12-ft fluorescent light fixtures to be installed in the new Hampton Roads, Va., tunnel between Hampton and Willougby Spit, Va., plus four 1,000-kva power centers, electrical panelboards and transformers. Value: $700,000.

• Issuing of a license by Westinghouse Electric International Co to Industria Metalurgica Tergal S/A of Brazil to use the company's periodic reverse plate plating process. The Brazilian firm expects to double its production with the process during the year.

• Westinghouse Electric International Co recently announced that Taiwan (Formosa) will have a complete high-efficiency 75,000-kw steam-electric plant, the largest generating unit on the island. The plant's total value is a reported $12 million, of which about $4.5 million is for electrical apparatus. The plant, located at Shen Ao, is being financed in part by the International Cooperation Administration. Westinghouse is also assisting the Formosan government in the training of technical and industrial personnel.

Firms Combine Efforts for Rectifier Installations

Bart-Messing Corp, Newark, N. J., and Pennsylvania Transformer Co, Canonsburg, Pa., have formulated an agreement to work jointly on design and installation of Sel-Rex germanium, silicon and selenium rectifiers for electrochemical and electrometallurgical applications. Bart-Messing will act as prime contractor.

The decision for the cooperative venture was predicated on customer preference for one centralized source of supply with responsibility for all accessory components. According to E. R. Redlhammer, vice president of Bart-Messing, and W. R. Swoish, vice president of Pennsylvania Transformer, each company will be responsible for, and guarantee its own components and equipment that are to be supplied for all installations.

Now *ONE* portable tool makes transmission line splices

OVERHEAD

It's no longer necessary for linemen to do the sagging and marking overhead and then lower the line to the ground for splicing. Now the complete operation, including splicing, can be performed overhead.

T&B's Forty-Ton Hydraulic Head has been specially designed for heavy-duty service in building transmission lines. Since it weighs only 36 pounds, this factory-rigged tool can be put into operation anywhere a man can throw a rope. Safety chains keep all removable parts from falling to the ground.

T&B's Forty-Ton Hydraulic Head, Cat. No. 21940, specially designed for transmission line building.

or ON THE GROUND

Demountable legs hold T&B's Forty-Ton Hydraulic Head at convenient working height when installations are being made on the ground. During operation, hardened steel dies compress fitting and cable hexagonally into one homogeneous mass . . . all in a few seconds. The same die set installs tension splicers, dead ends, loop splicers and taps, tees and terminals.

Modern hydraulic design has virtually eliminated the need for maintenance. However, field maintenance is simple and practical. The 21940 Installing Head can be completely disassembled and reassembled in less than one-half hour with these common tools: screw driver, Allen wrench, and mallet.

T&B Bulletin 70 gives a detailed description of the Forty-Ton Hydraulic Head as well as complete lines of T&B connectors, tools, and accessories for transmission line building. Send for FREE copy.

LOOK FOR THIS SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-418

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

[DATA FROM KW ENGINEERS]

CABLED ALUMINUM SECONDARIES

BY JACK ROCHE
ASST. CHIEF ENGINEER,
ELECTRICAL CONDUCTOR DIVISION

The price differential favoring aluminum over copper has led to an increased interest and use of aluminum conductor in distribution systems. The economic appraisal of aluminum vs. copper made by utilities usually includes a study of cabled aluminum secondaries.

Cabled Secondaries

Reliability and voltage drop in secondaries are of prime importance. Installation and operating costs, while still important, are not always governing factors in the selection of secondary construction standards. Cabled secondaries offer good possibilities.

Cabled secondaries could be underground, or aerial. If aerial, they could be field spun, preassembled with the conductors bound to the bare neutral, or cabled together around the bare neutral without a binder ribbon (Triplexed).

While underground is probably the more desirable, cost and flexibility ordinarily preclude its use. Aerial cable is neat, reliable and flexible. It has the desirable feature of reduced voltage drop and associated voltage regulation and can often prove out in an economic study.

One of the factors in favor of aerial cable is its aesthetic acceptability and associated improved customer relations. (At least one utility considers this to be worth an additional 50 per cent in construction costs.)

It makes no difference which aerial cable is selected, whether field spun, lashed, or "Triplexed" type cable. The following remarks apply in all cases except the basic cable cost study. Before choosing between field spun and preassembled cable, *total* installed costs should be figured.

The difference between the lower material and higher installation cost of the field spun cable, and the higher material and lower installation cost of preassembled cable should be considered. Satisfactory from field installation considerations and also more economical from first cost is the "Triplexed" type cable where the power conductors are spiralled around the bare neutral messenger.

Triplexed type cables may be supplied with a bare ACSR neutral having the same conductance as the phase conductors of the secondary or may have an extra high strength neutral to support service taps taken between poles. If satisfactory clamps are chosen and service taps are physically balanced, this type of construction may prove both economical and desirable.

By covering the following points, we may be able to summarize ideas on this subject:

1. **Electrical characteristics such as resistance, reactance, impedance and current carrying capacity (Table 1).**
2. **Physical advantages of cable over open wire.**
3. **Relative costs.**
4. **Construction suggestions.**

ELECTRICAL CHARACTERISTICS

	3C—Open Wire			3C Cable Full Size ACSR Neutral		
	#6 HD Copper	#4 HD Copper	#2 HD Copper	#4-7 AA	#2-7 AA	#1/0-19 AA
Resistance AC @ 20°C ohms/1000 ft.	0.4053	0.2549	0.1635	0.4157	0.2616	0.1644
Reactance—60 CPS ohms/1000 ft.	0.1206[1]	0.1153[1]	0.1087[1]	0.0308	0.0295	0.0283
Impedance—60 CPS @ 20°C, ohms/1000 ft.	0.4229	0.2798	0.1964	0.4169	0.2633	0.1646
% Reduction in impedance	.....	.....	.....	1.4	6.3	19.3

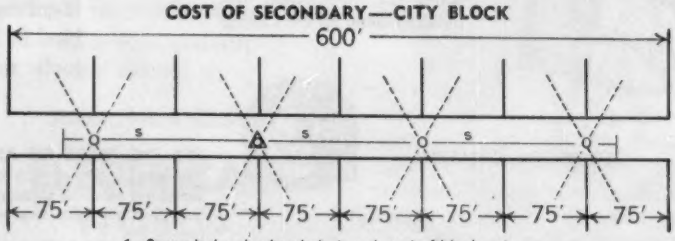
[1] Inductive reactance to neutral—1 ft. equivalent spacing.

Table 1

It may be noted in Table 1 that the reduction in impedance increases with the wire size. As the conductor size increases, the resistance becomes smaller, the reactance remains approximately constant and becomes an appreciable part of the impedance.

Voltage drop is dependent upon load power factor as well as impedance, but

COST OF SECONDARY—CITY BLOCK



1. Secondaries dead-ended at each end of block only.
2. —S— indicates 3-wire secondary—total length 450'.
3. △ Transformer.

The load indicated above probably could be supplied by #2 or larger. However, the above services were chosen to establish a relative connector and support relationship. Naturally, if fewer services are connected the smaller sizes could be used.

PRICES EFFECTIVE: Aluminum 11-1-56—Copper 10-25-56

	Open Wire—Weatherproof						Cable		
	TBWP Copper			Neo. ACSR—6/1			Neo. Triplex		
Conductor Size, AWG	6	4	2	4	2	1/0	4	2	1/0
Conductor Cost, $/1000 Ft.	70.43	108.85	169.97	62.10	83.70	136.35	60.75	81.00	131.85
Dead-End Cost Loop Type				6.00	8.70	8.70	2.00	2.90	2.90
Automatic	5.22	5.48	8.32						
Electrical Taps (48)	7.68	9.60	14.40	12.96	14.40	32.64	12.96	14.40	32.64
Power Conductor Taps							.36	.64	1.90
Tangent Supports	3.28	3.28	3.28	3.28	3.28	3.28	2.89	2.89	2.89
TOTAL	86.61	127.21	195.97	84.34	110.08	180.97	78.96	101.83	172.18

Table 2

in the larger sizes it is readily apparent that the reduced reactance of cable will result in lower impedance and voltage drop. Or, stated another way, if voltage drop is the limiting factor, greater load can be carried on secondaries if cable is used.

Physical Advantages of Cable Over Open Wire

1. Less tree trimming—reduced cost.

2. Greater clearance—if cable is used rather than vertical construction, there is less encroachment on telephone space allocated for joint construction. If cable is used instead of open wire, greater clearance is realized from buildings and other obstacles along the right-of-way.

3. Freedom from line outages during storms, since each wire is insulated from each other and from branches or other foreign objects.

4. Greater reliability, since the cable messenger, while it has the necessary conductance, also has sufficient strength to support the phase conductors during high wind storms. In an emergency the cable could still operate even lying on the ground.

5. Simple installation—one attachment at the pole as compared to separate insulators. Tapping cable is more difficult however, since each tap must be insulated.

The price comparisons shown in Table 2 are particularly slanted to the heavy loading district and may be subject to criticism for such long spans. If shorter spans, say 100 feet, are selected all-aluminum conductor could be used and open wire would probably be cheaper than the triplex type cable. Additional supports would not alter the comparison significantly since support costs are approximately the same for racks as for through-bolt insulator construction shown below.

Rack construction has been chosen for open wire, but if cross arm construction is used, the cost would probably be approximately the same.

Suggestions for Construction

In selecting triplex for secondary installations, it would be an advantage to specify a length of lay about 70 times the diameter of the phase conductor. Ordinarily, triplex length of lay is 60 times the power conductor diameter. This increased length will facilitate separation of the power conductors from the neutral at points of support and ease the job of electrical taps. At the same time the length is not so long that the phase conductors hang away from the neutral and look unsightly. *Caution*—If mid-span taps are contemplated use larger size neutral messenger.

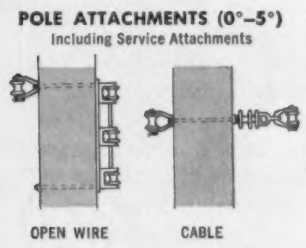
* * *

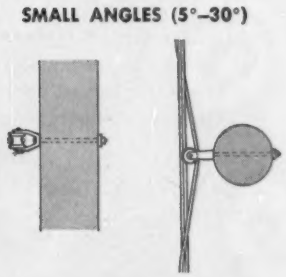
During the electric industry's rapid expansion, Kaiser Aluminum has concentrated intensively on utility problems—with special emphasis on covered wire.

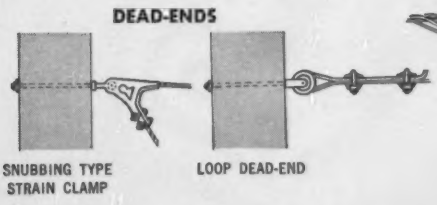
Today, Kaiser Aluminum is the nation's fastest growing producer of aluminum wire and cable, making available the latest helpful information on modern products and practices.

A Kaiser Aluminum representative or a KW distributor will be glad to give you immediate attention. Call your Kaiser Aluminum sales office. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland 12, California; *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois.

REPRINTS OF THIS ARTICLE AVAILABLE ON REQUEST



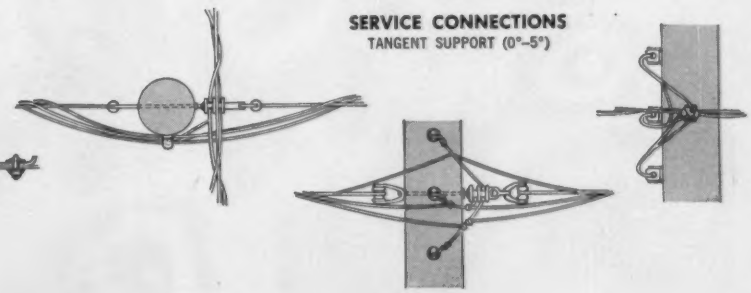


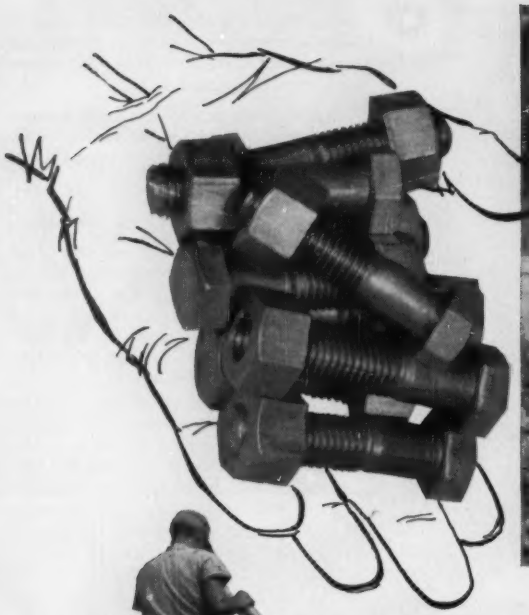


Aluminum is the answer to Adequate Wiring

Kaiser Aluminum

THE NATION'S LARGEST PRODUCER OF ALUMINUM WEATHERPROOF WIRE AND TRIPLEX





SIMPLICITY of

Thorex lightning arrester pays dividends in cost and protection

Only nine stacking bolts!

This 230-kv Thorex lightning arrester, 12½ feet high, consists of only four units. Three simple 3-bolt connections add practically nothing to construction time. The entire pole was completed in less than 30 minutes. This kind of time-saving has a real dollar value -- it makes Thorex arresters a better investment.

There's an operating angle to this of equal importance. In this 230-kv stack, there are only eight seals. Air and moisture are the enemies of an arrester. Regardless of how good the seals may be -- and we make good ones -- it is only plain common sense that fewer seals means greater safety.

Nobody wants a bargain in lightning arresters, unless it is a mighty sound bargain. But, add-up these factors: The finest grade of equipment protection - Lower construction costs - Higher reliability. How *better* could you spend your money?

OHIO BRASS COMPANY . MANSFIELD, OHIO

Ohio Brass

4634-H

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JANUARY 7, 1957

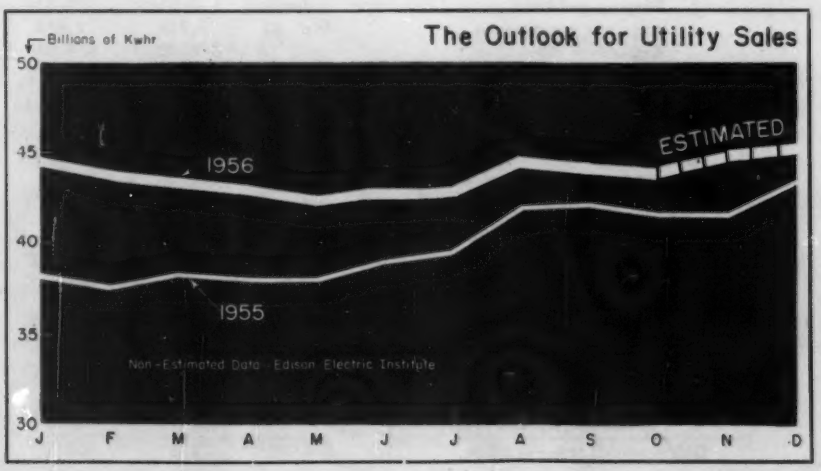
Cautious but firm optimism. That's the pervading note in the host of business forecasts that have crossed your desk in the past two weeks. Except for a couple of soft spots—mainly housing starts and the auto market—there's every prospect for a 1957 economy several notches above that of the year just closed. Gross National Product, the nation's total output of goods and services, is estimated to hit $435 billion—a gain of $25 billion over 1956.

Electrical manufacturers certainly share the optimism. An Electrical World sample survey of 15 manufacturers (p 99) indicates sales prospects ranging from 5% to 35% above last year. And remember these are solid, conservative forecasts backed by millions of dollars in plant expansion to meet the anticipated demand.

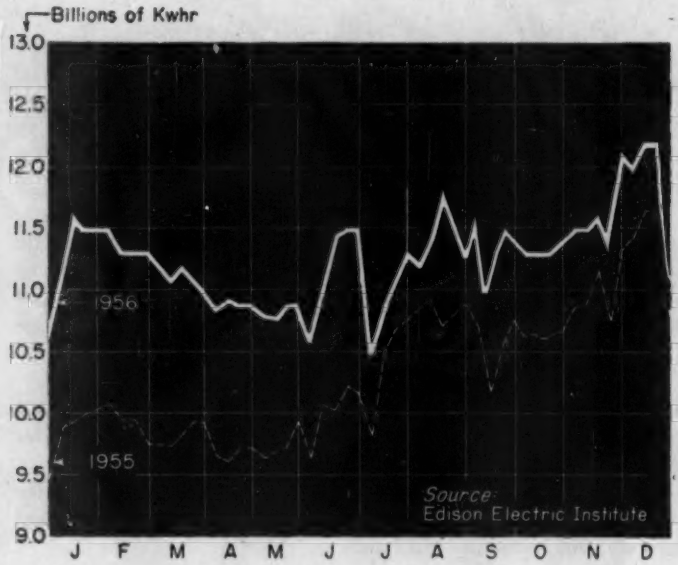
Note that makers of transmission and distribution equipment are most bullish. They talk in terms of 15% to 35% sales gains over 1956. New orders for power transformers, says one manufacturer, will be 25% ahead of the previous year. And for high voltage switchgear, orders are expected to rival or exceed the scare-buying that preceded the Korean conflict. Wire and cable, capacitors, and watthour meters will follow the upward trend.

Manufacturers of heavy generating equipment already have their eyes on 1960. They're in the process of completing orders for some 7½ million kw of capacity scheduled for delivery three years hence. Order boards now show units totaling 35 million kw for delivery this year and in 1958 and 1959. Besides the 7½ million kw already scheduled for 1960, additional plans will firm up during the course of the year.

Shipment of all electrical equipment in 1957 will hit $21½ billion, predicts the National Electrical Manufacturers Association. That's 10% above last year's total of $19.6 billion. According to the NEMA figures, shipments of illuminating equipment will climb to $913 million from $830 million last year. Industrial apparatus will climb to $3.2 billion from $2.9 billion last year. And generation, transmission, and distribution equipment will climb to $2.0 billion from $1.8 billion last year. Shipment of electrical appliances are expected to pass the $5 billion mark—up from $4.8 billion last year.



STATISTICS



OUTPUT

Week ended Dec. 29,
11,196,000,000 Kwhr
Up 4.6%

Per Cent Change From Previous Year

	Dec. 15	Dec. 22	Dec. 29
Total U.S.	+ 5.3	+ 5.3	+4.1
New Eng.	+ 4.8	+ 1.9	+2.3
Mid Atlantic	+ 3.4	+ 1.4	+0.9
Cent. Ind.	+ 4.8	+ 5.3	+3.9
West Cent.	+ 8.6	+ 7.6	+6.0
Southeast	+ 2.0	+ 4.5	+2.7
South Cent.	+11.6	+12.7	+9.4
Rocky Mount.	+ 9.4	+ 7.2	+9.5
Pacific			
NW	+ 7.7	+ 2.7	+6.6
SW	+ 9.7	+10.8	+6.6

Seasonally Adjusted Index 221.8
Week Ago 221.4
Year Ago 210.7

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity, Peak—Class 1 Systems, Estimated Dec. '56 Peak — million kw	Oct.	119.38	118.66	112.13	6.5
Peak—Class 1 Systems — million kw	Oct.	96.6	96.5	90.7	6.5
Estimated Dec. '56 Peak — million kw	Oct.	106.20	106.17	104.34	1.8
Production—billion kwhr	Oct.	51.13	48.82	47.70	7.9
Hydro		9.24	8.96	8.80	4.9
Fuel		41.89	39.86	38.60	8.5
Sales—billion kwhr	Oct.	45.98	46.07	43.06	6.8
Residential		11.27	11.68	10.38	8.6
Commercial		7.37	7.82	6.88	7.1
Industrial		24.79	23.86	23.34	6.2
Other		2.56	2.72	2.45	4.5
Fuel Consumption	Oct.				
Coal—million tons		13.52	12.45	12.65	6.9
Oil—million barrels		6.27	5.20	6.04	3.8
Gas—million cu ft		114.36	124.63	104.80	9.1
Net Income Class A & B Co's—$ million	Oct.	95.79	108.45	94.61	1.2
Residential Customers—millions	12 mos. ended Sept. 30	45.39	45.25	44.09	2.9
Revenue per kwhr		2.61¢	2.61¢	2.66¢	−1.9
Avg kwhr per customer		2,929	2,914	2,700	8.5
Avg annual bill		$76.45	$76.06	$71.82	6.4

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Dec.	147.6	147.6	141.1	4.6
BLS Cost-of-living	Nov.	117.8	117.7	115.0	2.4
New Orders for Machinery (1950 = 100)	Oct.	140	139	143	−2.1
NEMA Sales					
Insulation materials	Oct.	170	147	156	9.0
Electric appliances		94	101	96	−2.1
Wholesale prices	Oct.				
Motors and generators		136.9	136.2	125.3	9.3
Transformers and regulators		144.8	144.8	129.2	12.1
Switchgear and fuses		161.9	157.0	146.3	10.7
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

MANAGEMENT BULLETIN

FINANCE

Interest rates for the next few months will show no appreciable drop from current levels. This is the prediction of a number of economists as 1957 bows in. In fact some say that they will go slightly higher. This is bad news for the electric utilities. They have scheduled at the moment around $225 million new securities to be sold in January alone. This compared with a little over $22 million in January, 1955.

The question of selling securities competitively or on negotiated basis has again arisen. Contestants: Halsey Stuart & Co for competitive bidding and Harriman, Ripley & Co for a negotiated deal on $46,224,200 Niagara Mohawk Power Corp debentures. Scene: New York PSC. Niagara Mohawk had agreed to a negotiated deal with Harriman, Ripley. When Halsey found out, it wired Niagara Mohawk's Pres Earle J. Machold that it would submit a competitive bid at not less than the subscription price and without a fee. Machold wired that we do not expect to offer them competitively. Halsey then sought a PSC hearing. At the hearing Lincoln J. Patton of Halsey said he would guarantee a bid eliminating compensation to itself other than a fair and reasonable profit on the unsubscribed debentures. Ripley countered that Niagara Mohawk common has been under pressure since the rock slide wrecked the power plant and it would be unsatisfactory if its first pre-emptive offering since then was poorly received.

Electric properties in Independence, Mo., owned by Kansas City Power & Light Co will soon be turned over to the city for $2,385,000 plus additions and retirements since Jan. 1, 1956. City will purchase the power needed from KCP&L until a plant to be built in the Little Blue River Valley, east of Independence, is completed in 1958. Missouri PSC has approved the order.

RATES

Reductions of $556,440 annually in electric and gas rates for customers in unincorporated areas where population densities have increased have been announced by the Pacific Gas & Electric Co. Formal filing with the California Public Utilities Commission brought to $1 million the total in rate reductions for domestic and small consumers filed by the company with the PUC in 1955.

Authority for a temporary rate under which Seattle City Light could sell surplus power from its Skagit River plant has been requested of the City Council by Paul J. Raver, City Light superintendent. Flow has been so high, Raver said, that City Light neither can utilize all the water for its power needs nor store it in already-filled reservoirs. A rate of 2.5 mills per kwhr was suggested for industries and utilities other than the Bonneville Power Administration and City of Tacoma, whose rates are fixed by contract.

TAXES

A request for repeal of the federal excise tax on transportation of persons and property has been made in a letter to Chairman Aime J. Forand of the House subcommittee on excise taxes by Pennsylvania Power & Light Co's Pres Chas. E. Oakes. He claims that they create an unfair burden on the company's customers as electric service include the cost of these excise taxes.

ADVERTISING

"Better Copy Contest" of Public Utilities Advertising Association is now awaiting your entries. There are 189 awards in 21 classifications. Deadline is Feb. 1 on ads and April 1 on annual reports. For copy of rules book, write Frank C. Leitz, chairman 1957 Better Copy Contest, Northern Illinois Gas Co, Bellwood, Illinois.

Management group of Electric Companies Advertising Program meets at Delmonico Hotel, Park Avenue and 59th Street, New York City on Jan. 9 at 10 A.M.

to discuss atomic electricity advertising. ECAP's ad to be run in leading mags in January and February will have the slogan "Where *Do* Your Taxes Go?"

Using the punchline "Poor George Doesn't Know . . ." Northern States Power Co adds these slogans "One Penny Gives Him 200 Smooth Electric Shaves"; "One Penny Runs TV One Full Hour"; and "One Penny Vacuums 12 Room-Size Rugs."

PUBLIC RELATIONS

An illustrated historical booklet giving many of the dramatic facts of Alabama Power Co's half century of progress has been prepared. For copy, write L. M. Smith, president, Alabama Power Co Building, Birmingham, Ala.

Niagara Mohawk Power Corp's employees are on TV. Alternating each week with regular commercials, on "Dr Hudson's Secret Journal" show at Watertown, N. Y., viewers get a close look at the skills, equipment, and experience of Niagara Mohawk's employees on 2½ min institutional commercials.

An updated Atomic Energy Information Kit will be available by Feb. 28 by the Electric Companies Public Information Program, through Bozell & Jacobs, Inc. For copy, write Donald Hoover, president, B&J 2 West 45th St., N. Y.

YOUR HEALTH

New Year's Resolutions

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co.

With the advent of a new year, it is worth while for each of us to resolve to take better care of our most important asset—ourselves. We are living in an age where the average life expectancy is steadily increasing. The prevention of disease and the promotion of health are of prime importance to everyone. All of us want to live healthily and happily for just as long as we can.

Today the greatest threat to our children is accidents. In years past infectious diseases were the most frequent hazards to a child. We must resolve to educate our children as thoroughly as possible to the dangers of our modern world. Just crossing the street at the wrong time can be fatal. The home life of a child is important, too. For a youngster to grow into a mature adult he must receive large amounts of love and affection along with strong doses of discipline. We must resolve to teach our children the difference between right and wrong early in life. If our child has a personality disorder, we must recognize it and seek to correct it as quickly as possible.

Throughout life it is imperative to have physical checkups. Relatively few diseases cause most human miseries. Many of them can be prevented or corrected. So, we must resolve to consult our physician regularly for examinations before we become ill in the hope of detecting any incipient disease.

The physician should make a resolution, too. He should resolve to check his patients as thoroughly as he can, using all of the modern means at his disposal. He should pay particular attention to his patient's emotional state. He should recognize that the stresses and strains of modern living are as much of a hazard to our longevity as are diseases and injuries arising from accidents. "The more complete the examination the better off the patient" is a good medical maxim.

We also should resolve to help the elderly live a full life. He should be encouraged to work within his abilities, to exercise to his tolerance, and to play to his heart's content. The person over fifty should resolve to live in moderation in all things.

This new year will provide, in ever increasing amounts, more and more hazards for everyone. There will be bigger and faster cars to be aimed at us. There will be more ways created for us to get hurt. There will be many diseases lurking to trouble us. All of us from time to time will experience fear, loneliness, frustration and worry. Each one of us should resolve to take the best care that we can of this wonderful body of ours. We should enlist the aid of our family physician in helping us keep our minds and bodies in good running order. In addition our most important resolution should be to develop a sympathetic understanding of the problems of our fellow man because in so doing, we avoid having the same problems ourselves.

Let's all resolve to have a healthy, happy new year!

Are you missing something in Electrical World ?

You are now reading the NEW end-product of 82 years of publishing service to the electric power industry. We'd like to think it's perfection itself, but we know better. It's only as good as we can make it, and it probably won't even retain its present format for any great length of time, if past experience with our readers is any criterion. For Electrical World, now, is as accurate an answer to your wants and needs — in total, the requirements of our industry — as we can make it. *When those requirements change, so too will Electrical World.* But to make sure that you get from our new make-up everything that's been put here for you, let's take a fast tour of the changes we've made.

Right now, have a look at the complete, compact, 2-minute summary of the book, printed on special yellow stock at the front. Here is *the gist* of what's going on in the industry! "Newscope" covers future and late news; "Electrical Week" examines events, generation, distribution, commercial, management, people, manufacturing, and new equipment; "Engineering Trends" briefs *that* aspect of issue content. This specially written summary in the front of each issue, on yellow stock for easy finding, gives you *the complete overall picture of the industry and everything affecting it for the past week!* It mirrors the contents of each issue for absorption almost at a glance — let's you invest your Electrical World reading time more profitably.

Then there's the *second* yellow-stock insert, at the back of the book. In this one you'll find our exclusive "Electrical Business Outlook." We believe (because you've told us so) that our "EBO" page, as it's coming to be known, is *the best interpretation of what is important to management to be found in the industry.* Accompanying Electrical Business Outlook will be the statistics — the weekly output chart, as well as power and general business statistics. Here you'll see industry progress defined as it takes place, by the week, in terms of capacity, peak load, production, power sales and customers, accompanied by general business statistics for easy comparison. Too, you won't want to miss the special page, "Atomic Progress," a rapid-reading view of latest developments on the nuclear power front. And in "newsletter" form, treatment of the problems management is constantly concerned with: Financial, Rates, Regulation, Public Relations, and Industrial Relations, closing with the popular "Your Health" feature.

Larger type throughout the whole book is the order of the day, dictated like all other changes by the very real need for a faster, more efficiently read weekly magazine. With all this will come a new, more complete, more descriptive Contents Page; a Publisher's Column, to keep you informed of coming editorial features and new services; "Washington" will appear as a new, every-week run-down on the industry scene in the capitol. *Put all this on a firm foundation of the most complete, intensive reporting coverage available to any business publication, and you'll see why, more than ever before, Electrical World has earned the right to be known as . . .*

"The Electrical Industry's Weekly Magazine"

NEWS ABOUT PEOPLE

FP&L Ups Johnson to VP

LOFTIN JOHNSON

Florida Power & Light Co has announced the election of Loftin Johnson as operating vice president of the utility.

Johnson joined FP&L in 1935, shortly after graduation from the University of Florida. Starting as substation operator, he rose to division load dispatcher, junior engineer, acting junior engineer, and assistant engineer in 1943. Soon after his return from military service in 1946 Johnson assumed the dual post of distribution supervisor in Cocoa and transmission supervisor in Northern and Northwest Divisions. His promotion to regional coordinator for Northern, Northwest, and North Central Divisions in 1950 was followed the next year by his advance to assistant supervisor of transmission and distribution in Northern Division. In 1951 he was named Western Division manager, and became superintendent of division operations in 1952. The next year he was named superintendent of transmission and distribution. He became manager of electric operations earlier this year.

Doyle and Baker Elected to Executive Posts

R. E. DOYLE, JR.

R. E. Doyle, Jr, previously vice president and general manager of Kentucky Power Co, has been named vice president and assistant general manager of Indiana & Michigan Electric Co. He is succeeded as Kentucky Power vice president and general manager by F. M. Baker.

A graduate of Virginia Polytechnic Institute, Doyle has been with the Kentucky utility since 1930. After serving as construction engineer, he rose to general manager in 1948 and was elected to the company's board of directors and to the vice presidency in 1952.

Baker joined Kentucky Power in 1931 as an engineer and was subsequently named Pikeville district manager. A Massachusetts Institute of Technology graduate, Baker was named assistant general manager at Ashland earlier this year.

F. M. BAKER

Bencher Promoted to VP

WALTER S. BENCHER

Newly elected vice president of Combustion Engineering, Inc, is Walter S. Bencher, who previously served as controller.

Bencher has been a member of the Combustion Engineering organization since 1941, when he joined the company as an engineer assigned to the standards group of the proposition department.

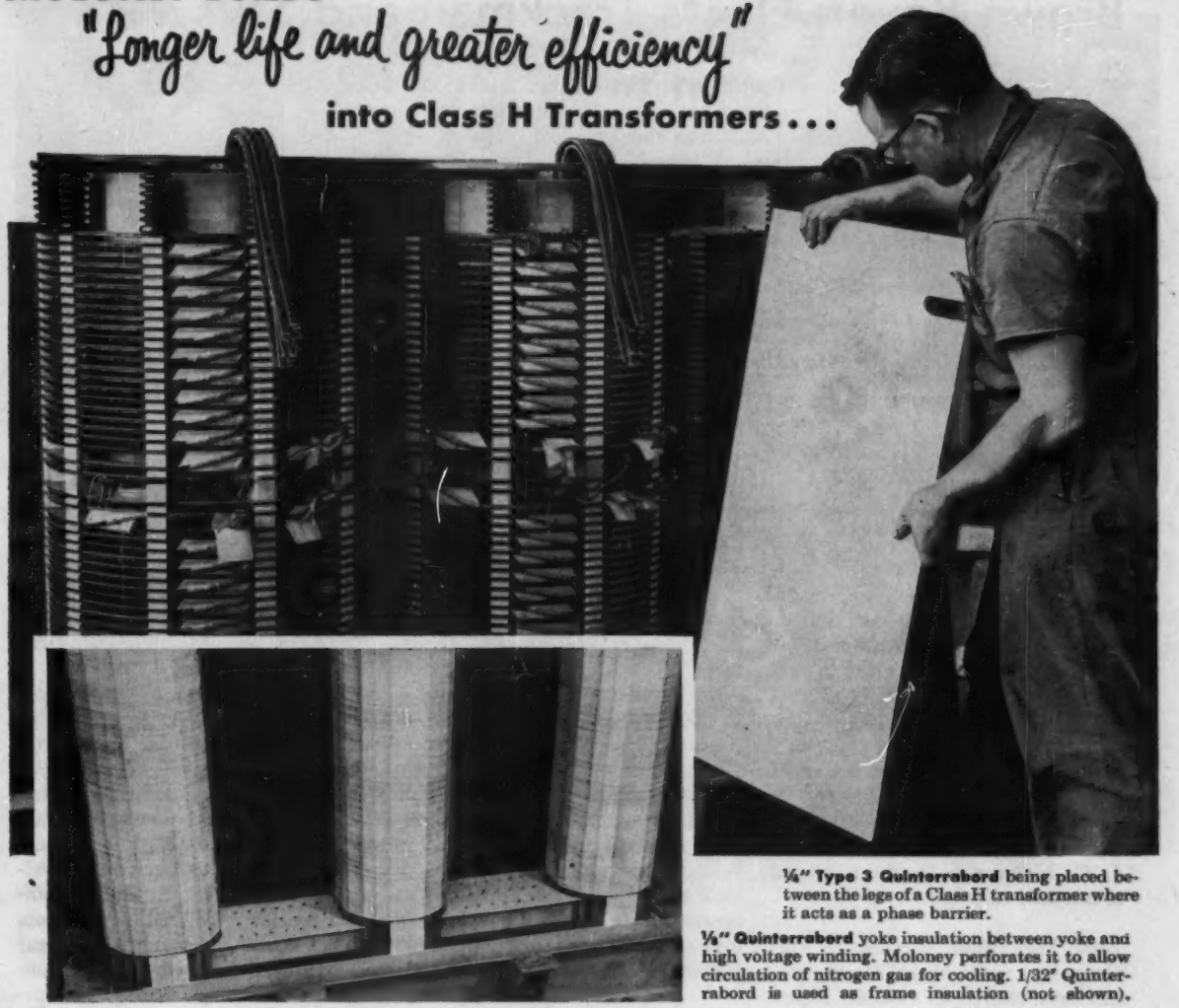
He subsequently transferred to the firm's accounting department, where he was appointed to the position of assistant controller in 1952. He was elevated to his most recent post as company controller the following year.

The new vice president is a member of numerous professional organizations, including the American Society of Mechanical Engineers, the Controllers Institute of America, the Engineers Club of New York, and of the National Association of Cost Accountants.

MOLONEY BUILDS

"Longer life and greater efficiency"

into Class H Transformers . . .



¼" Type 3 Quinterrabord being placed between the legs of a Class H transformer where it acts as a phase barrier.

⅛" Quinterrabord yoke insulation between yoke and high voltage winding. Moloney perforates it to allow circulation of nitrogen gas for cooling. 1/32" Quinterrabord is used as frame insulation (not shown).

. . . with J-M Quinterrabord® Type 3 Electrical Insulation

In keeping with the trend toward higher temperature operation of electrical equipment, Moloney Electric Company, St. Louis, Missouri provides the ultimate insurance against failure—J-M Type 3 Quinterrabord. Incorporated in sealed nitrogen filled transformers, the lasting insulation value of J-M Type 3 Quinterrabord insures long life and efficiency with no possible chance of shorting out under continuous high temperature or overload.

Type 3 Quinterrabord is a specially processed sheet of highly purified asbestos fibres, subsequently treated with silicone. This treatment insures moisture and corrosion resistance. Free from impurities, uniform in texture and thickness, Quinterrabord has high pyrolysis resistance (thermal stability) and lasting dielectric strength. As installed, it is not cured so remains somewhat flexible. Then, when subjected to increased temperature and pressure in operation, curing takes place with a resultant increase in mechanical and electrical properties.

Folder EL-89A gives the complete story. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS

Brown Boveri Elects Trackman and Stys VP's

JOHN C. TRACKMAN

Paul R. Sidler, president of Brown Boveri Corp, has announced that the firm's board of directors has appointed two new vice presidents—John C. Trackman and Z. Stanley Stys. Their appointments became effective Jan. 1.

Trackman, in his new position, will be in charge of a recently organized department in the company which deals with special electrical equipment.

Stys, as vice president, will continue as head of the Brown Boveri Mechanical Equipment department.

Z. STANLEY STYS

PERSONAL BRIEFS

Pacific Gas & Electric Co has appointed **George L. Works** as division manager at Stockton, Calif., succeeding **Clair V. Wilbur,** retired. **Kenneth C. Porter,** assistant manager of the tax department in San Francisco, will replace Works as manager of the De Sabla Division.

E. N. Mitchell, superintendent of the general meter department of West Texas Utilities Co has been named supervisor of personnel. **J. G. McKeown,** has been named to succeed Mitchell.

New York State Electric & Gas Corp has made these recent promotions. **Robert C. Friends,** supervisor of the Elmira commercial office, has been named Geneva district commercial office manager, succeeding the late **Joseph T. Fannell. Joseph A. Lynch,** supervisor of the Dansville district commercial office will succeed Friends. **Raymond D. Lefferts,** supervisor of the Hornell district commercial office has been named to succeed Lynch. **Gerald Edsell,** a cadet specializing in the commercial office, will succeed Lefferts.

Gerrit H. Van Hengel, a staff engineer of Detroit Edison Co's Planning and Project Engineering Department, has retired.

Public Service Co of Oklahoma's Chairman **R. K. Lane** was recently named to the Hall of Fame of the Oklahoma Institute of Technology, A&M's engineering school.

Carolina Power & Light Co has announced the following personnel changes to take effect on Feb. 1: **J. V. Henderson,** Rockingham district manager, will become Goldsboro district manager, succeeding **Fitz Lee** who will retire on Feb. 1. **R. W. Talton,** local manager at Zebulon, will go to Rockingham as district manager. **F. T. Scarborough,** local manager at Dillon, will become Zebulon local manager. **F. C. Lennon,** assistant district manager at Wilmington, will go to Dillon as local manager. **J. M. Hall,** district operation headquarters office in Raleigh, will replace Lennon in Wilmington.

Detroit Edison Co has made the following appointments: **Frank M. Kehoe,** supervising accountant of the general accounting department; **Charles W. Peters,** assistant to the superintendent of district customers accounts department; **Albert C. Baumann,** superintendent of electrical system equipment; **Fred Knippenberg,** assistant to the superintendent of electronic data processing department; **Ernest W. Spring,** superintendent of substations; **Frank Kunze,** inspection and equipment engineer; **Leslie W. Rivard,** superintendent of Delray Plant; **Paul Murphy, Jr,** assistant superintendent of Delray plant; **John R. Hamann,** superintendent of Conners Creek plant; Leo J. Romzick, assistant superintendent of Conners Creek plant; **Kenneth Ellison,** engineer, electrical on general offices staff.

General Electric Co has made these appointments: **Louis E. Newman,** manager of the newly-formed insulating materials section of the Chemical and Metallurgical Division; **William Alvarez,** manager of engineering for the GE Industry Control Department, Roanoke, Va.; **James G. Henzel, Jr,** applied research engineer for GE's Foundry Department Applied Research and Development Laboratory; **Donald S. Holmes,** quality control engineer of the Applied Research and Development; **Frederick E. Dator,** manager-finance for GE's Medium Steam Turbine, Generator and Gear Department; **Kenneth G. MacDonald,** product sales manager of furnaces and associated equipment in GE's Industrial Heating Department.

Allis-Chalmers Manufacturing Co has appointed **L. T. Rosenberg** as chief generator design engineer and **G. W. Staats** as engineer-in-charge of the generator design section.

OBITUARY

Bently Smith Handwork, 70, who retired in 1954 as chairman of the board of Joslyn Mfg. & Supply Co, died in an automobile accident near Colton, Calif., recently.

Terryl B. Montgomery, 56, chief engineer for Allis-Chalmers Manufacturing Co, died recently in Milwaukee, Wis., of a heart attack.

(Left to right) Dr. John Bardeen*, Dr. William Shockley* and Dr. Walter H. Brattain, shown at Bell Telephone Laboratories in 1948 with apparatus used in the early investigations which led to the invention of the transistor.

Bell Telephone Laboratories Salutes Three New Nobel Prize Winners

Drs. John Bardeen, Walter H. Brattain and William Shockley are honored for accomplishments at the Laboratories

The 1956 Nobel Prize in Physics has been awarded to the three inventors of the transistor, for "investigations on semiconductors and the discovery of the transistor effect."

They made their revolutionary contribution to electronics while working at Bell Telephone Laboratories in Murray Hill, N. J. Discovery of the transistor was announced in 1948. Bell Laboratories is proud to have been able to provide the environment for this great achievement.

This is the second Nobel Prize awarded to Bell Telephone Laboratories scientists. In 1937 Dr. C. J. Davisson shared a Nobel Prize for his discovery of electron diffraction.

Such achievements reflect honor on all the scientists and engineers who work at Bell Telephone Laboratories. These men, doing research and development in a wide variety of fields, are contributing every day to the improvement of communications in America.

**Dr. Bardeen is now with the University of Illinois, and Dr. Shockley is with the Shockley Semiconductor Laboratory of Beckman Instruments, Inc., Calif.*

Bell Telephone Laboratories

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

MEETINGS CALENDAR

JANUARY, 1957

Northeastern Weed Control Conference — Sheraton-McAlpin Hotel, New York City, Jan. 10-12.

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

Edison Electric Institute—Industrial Relations Committee, sponsored jointly by personnel section of Southeastern Electric Exchange, Sheraton-Park Hotel, Washington, D. C., Jan. 17-18; Industrial Power & Heating Group, New Orleans, La., Jan. 17-18.

Southeastern Electric Exchange—Personal Administration Section Meeting, held jointly with EEI, Sheraton-Park Hotel, Washington, D. C., Jan. 17-19.

Atomic Industrial Forum, Inc—Forum Insurance Meeting, final report of the Forum-sponsored Columbia University study on "Financial Protection against Atomic Hazards," Plaza Hotel, New York, N. Y., Jan. 21-22.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

Pennsylvania Electric Association—Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Pa., Jan. 24-25; Transmission & Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., Jan. 31-Feb. 1; Hydraulic Power Committee, Brunswick Hotel, Lancaster, Pa., Jan. 31-Feb. 1.

American Welding Society—Illinois Institute of Technology—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

FEBRUARY

Ninth Annual Industrial Engineering Institute—University of California, simultaneous sessions in Berkeley and Los Angeles, Feb. 1-2.

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

Edison Electric Institute—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Alabama, Feb. 14-15.

Pennsylvania Electric Association—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee & Systems Operation Committee, Philadelphia, Pa., Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

National Electrical Manufacturers Association—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuit Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

13th Annual National Adequate Wiring Conference—Sherman Hotel, Chicago, Ill., Feb. 21-22.

North Central Electrical League—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

Engineers Joint Council—(in coordination with 20 engineering and scientific societies) 2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition; 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

Northwest Electric Light & Power Association—Business Development Section, Empress Hotel, Victoria, B. C., Mar. 18-20.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Pacific Coast Electrical Association—Engineering & Operating Section, Hotel Statler, Los Angeles, Mar. 21-22.

Oklahoma Utilities Association—Biltmore Hotel, Oklahoma City, Okla., Mar. 27-28.

Illinois Institute of Technology—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

APRIL

Southeastern Electric Exchange—Annual Meeting, Boca-Raton Hotel, Boca Raton, Fla., April 1-3.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

• **Edison Electric Institute**—Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; Main Accounting Conference, held jointly with AGA, Washington, D. C., April 8-10.

American Society of Mechanical Engineers—Spring Meeting, Birmingham, Ala., April 8-10.

American Welding Society—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, College Station, Texas, April 15-17.

Pacific Coast Electrical Association, Inc—Hotel La Playa, Carmel, California, April 24-25.

• Additions this week

when a job is this hot...

It's 10:30 P.M. The new substation is behind schedule and your engineer is working late to meet the deadline. When it comes time to specify components, **delivery** will naturally be an important question. So Royal will be the logical choice to furnish the switchgear and connectors.

Royal's compact operation is purposely kept flexible—so each order gets custom service and **delivery when needed.** The "Royal treatment" is no idle phrase . . . it's a customer pledge we live by.

Whether your project is normal or rush, large or small, you'll like dealing with Royal—for switchgear, any one of 5,000 standard connectors, or a special design to be engineered. Save time—call Royal first!

ROYAL

A part of the arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

- **Selenium?**
- **Germanium?**
- **Silicon?**

You get all these *pluses* when you use Walker Rectifiers: low DC ripple — about 4% . . . low cost . . . long, efficient life . . . no maintenance. All Walker Rectifiers are designed and built to the highest standards, with the highest quality components.

With Walker Rectifiers you install them and forget them as far as maintenance or repair is concerned. Get full details on Walker Rectifiers — Selenium, Germanium or Silicon — write for complete details or engineering assistance.

NORMA-HOFFMANN The Walker DIVISION BEARINGS CORPORATION

THE WALKER DIVISION

NORMA-HOFFMANN BEARINGS CORPORATION

Stamford, Connecticut

READERS FORUM

"K" Factor Discussed

To the Editor:

In your Readers Forum for Sept. 3, you quote an interesting letter from the president of Continental Radiant Glass Heating Corp with reference to the "K" factor to be used in the NEMA formula for calculation of annual kilowatt-hour requirement for space heating. Reference is made to your March 19, 1956 edition indicating that the "K" factor was 270.

Subject letter, in quoting "K" factor of a magnitude between 170 and 270, identifies the formula in which this factor appears as that used by Federal Housing Administration in estimating annual kilowatt-hour requirement. In this formula the "K" factor is 170. Could you send us tear sheet of your March 19, 1956, edition showing the Detroit Edison test in which this "K" factor is 270?

The NEMA formula also has a variable constant used in calculating annual kilowatt-hour requirements. This constant varies between 12 and 18.5, depending upon variation in weather conditions, orientation of building, and manner of use.

Actually either the FHA or the NEMA formula can be used interchangeably; and if proper values for the constants are chosen, the two formulas give identical results. The relationship between the two constants is that their product is equal to 3412 and the range of the NEMA constant between 12 and 18.5 implies a range in the FHA constant between 284 and 184 with a mean at 224; so actually FHA predicts higher kilowatt-hour consumption since they insist on a factor of 170 which translates into a NEMA factor of 20 which gives an estimated kilowatt-hour consumption which is 8% higher than the highest predicted by NEMA.

Actually the kilowatt-hour consumption required to heat any building depends more upon the construction of the building than on any other factors except that if the heating equipment installed is not capable by virtue of its size or shape of supplying the heat loss of the building at the point where it occurs, then it cannot give the ultimate in comfort value with the enevitable result that unrealistically high thermostat settings must be used to attain comfort. These higher settings will invariably result in greater energy consumption.

What is most needed in every electric heating application is an honest heat loss calculation based on realistic construction specifications which are faithfully translated into practice.

W. L. Thomson, Manager
Radiant Heater Division
Edwin L. Wiegand Co
Pittsburgh 8, Pa.

Has Meter Collection

To the Editor:

I was most interested to see the "Meter Museum" article in the Nov. 19 "Electrical World." It is very certain that if any effort is to be effective in preserving relics of our electrical development it is high time such efforts were initiated. An article such as this is very stimulating.

Over the years we have accumulated quite a respectable collection of electric meters here in Toronto. Among the older and more interesting specimens are:

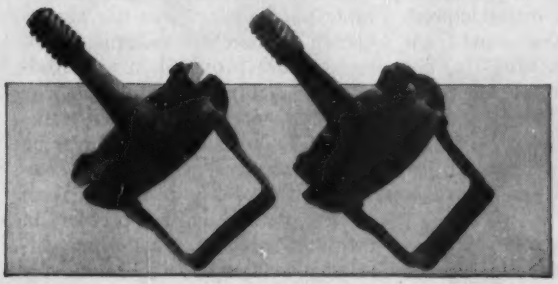
Pattee's Improved Lamp Hour Meter
Gutman Type A
" " B
Scheiffer Type E (Diamond Meter Co)
Duncan Type A (Siemens & Halske of America)
Stanley (magnetic suspension)
Aron (differential pendulum)
Peterborough
Bat (Board of Trade Units)
Baldwin Electric Meter (made in Washington, D. C.)

This collection is available for study or photographing to any responsible student of meter history. It is housed in glass fronted wall cases and is on permanent display at Sangamo Co, Ltd, Leaside Plant.

G. G. Waite
Vice President,
Engineering
Sangamo Co, Ltd
Leaside, Toronto 17, Canada

ADVERTISEMENT

Cor-Ten® steel hardware eliminates costly replacement trips



Many utility companies make a practice of replacing all hardware on a pole even when only a few pieces are actually in need of replacement. They do this to eliminate costly return trips* to the same pole to replace the balance of the hardware as it wears out. Although this might seem wasteful, it proved to be the least costly method of handling the situation—until recently.

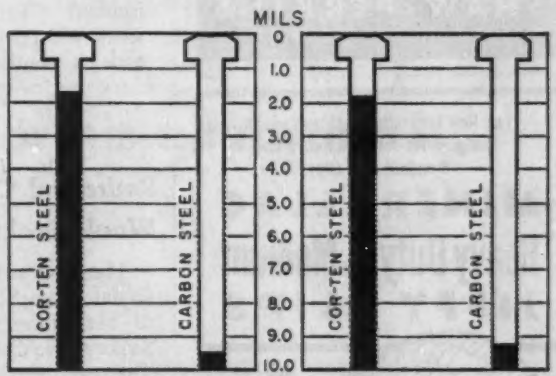
**The average utility pole mounts between fifteen and twenty pieces of hardware. Here's what happens when one or more pieces of hardware corrode beyond further use: A minimum crew of one lineman and helper proceeds to the trouble spot (average travel time ½ hour). Tools and equipment are unloaded from the truck (average unloading and reloading time ½ hour). The lineman must take certain safety precautions if the line is to be worked "hot" (average time for safety measures 15 minutes).* Then *the lineman starts to work replacing the corroded hardware. Time elapsed: 1¼ hours* each *for two men* plus *time consumed actually replacing the hardware. This does not include cost of the vehicle, its maintenance, equipment costs, etc.*

Today, manufacturers of pole line hardware—particularly that hardware which is to be used in industrial and marine atmospheres—are turning to a stronger, more corrosion-resistant metal—USS Cor-Ten High-Strength Low-Alloy steel.

Utility companies can now set a pressure-creosoted pole, install Cor-Ten steel pole line hardware, and expect the same amount of service life from *both pole and hardware.* By eliminating one, two, and even more repair trips to the pole, savings, both in time and equipment, are impressive. Multiply those single-pole savings by the total of all poles erected annually by your company. The result should leave no doubt about the economy of using Cor-Ten steel pole line hardware.

Compared to carbon steel, Cor-Ten steel hardware is normally furnished with a zinc coating that gives it initial added protection when the hardware is first installed. The true advantage of Cor-Ten steel becomes evident after the zinc coating is gone. At that point, Cor-Ten steel forms a smooth, tightly adhering coat of oxidation that keeps moisture from penetrating and thus slows down further corrosion. This difference in rate of corrosion is illustrated by the graphs in this column showing corrosion loss after 3.5 years of exposure in marine and industrial atmospheres. Naturally, the more corrosive the atmosphere, the more accelerated will be the rate of corrosion. But even in the extremely corrosive conditions found near the sea and around industrial areas, Cor-Ten steel hardware can be expected to last the life of a treated pole, while carbon steel hardware normally requires replacement twice during the life of a pole.

The second important advantage of Cor-Ten steel—its greater strength—means that even if Cor-Ten steel hardware corroded as rapidly as carbon steel (which it does *not*), hardware made from Cor-Ten steel would still stay on the job, safely resisting stresses long after carbon steel hardware was ready for the scrap pile. In other words, you can expect your Cor-Ten steel hardware to last at least 50% longer than hardware made from carbon steel.



WHITE AREA REPRESENTS CORROSION LOSS IN MILS; BLACK AREA REPRESENTS SOLID METAL.

FIGURE 1: Comparative corrosion loss in mils of USS Cor-Ten Steel and structural carbon steel exposed for 3.5 years in *marine* atmosphere at Kure Beach, N. C.

FIGURE 2: Comparative corrosion loss in mils of USS Cor-Ten Steel and structural carbon steel exposed for 3.5 years in *industrial* atmosphere at Kearny, N. J.

USS Cor-Ten steel has been out-performing carbon steel on hundreds of applications all over the world for the past twenty years. Its superior strength and corrosion-resistant qualities are not just drawing-board theory but time-proven, budget-cutting fact. You'll find the whole story in a booklet called "USS Cor-Ten Steel Pole Line Hardware." Write for a copy to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

SHAW-PERKINS
COOLING
RADIATORS

. . . properly designed to cool power and distribution transformers

Designed and built by the pioneers and specialists in economical, dependable self-cooling methods. Sizes and models for any make transformer. Valves, flanges, elbows available. Transformer tanks built to customer's design.

Write for full information. SP-11

MANUFACTURED BY
SHAW-PERKINS
201 EAST CARSON ST. • PITTSBURGH 19, PA.

Two New Mineralac Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

MINERALAC
Heavy Duty AND Medium
JIFFY CLIPS

Also available without mounting hole for use with gun.

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

SEND FOR LITERATURE
MINERALAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, Ill.

MINERALAC

System Relaying Modernized

(Continued from page 59)

program was installation of bushing current transformers in transformers and circuit breakers. Absence of CT's was probably the main reason why relays were not added sooner.

It was quite difficult to install bushing CT's. The manufacturers designed adapters that would accommodate two sets of CT's, but required replacement of the high-voltage bushings. Toledo Edison found it necessary to use h-v bushings with long ground sleeves to get enough clearance in many transformer tanks.

Installation of the voltage differential relay on substation buses presented a problem of CT connections. A cabinet was designed to facilitate connections for readily testing each set. Size of the cabinet depended upon the number of circuits radiating from the substation.

In the installation of the bus differential relays, a monitoring scheme detects a faulted or open-circuited CT connection. Experience with grounding of CT's has made it routine for operators to check periodically every bus differential installation for grounds or open circuits. Connections were provided for these checks.

Installing relays and making connections to existing and new CT's were extremely difficult because the ratio and polarity were not always known. Therefore adequate test means were provided in all installations. Actual load or short circuit tests were performed on transformer differentials before placing them in service.

Absence of h-v circuit breakers often presented another problem in the installation of transformer differential relaying. To overcome this difficulty, transfer trip to remote substations was used for clearing the fault.

The company adopted a double tone transfer trip using one guard frequency and a tripping frequency over leased telephone wire. Where telephone circuits were not available, transfer trip over carrier was used. As some transformers were tapped to three terminal lines, the differential installation required transfer tripping to three points.

Redrafted Columbia Pact Would Prohibit Diversion

The proposed Columbia River Interstate Compact has been redrafted to bar diversion from the upper Snake to the Colorado River system. The anti-diversion clause was one of two major changes made by the seven-state compact commission before approving a final draft to be presented to state legislatures in 1957.

The other major change simplified provision for allocating power among member states. The new power section calls for "fair and equitable apportionment and allocation among the states of the hydro-electric power developed in the Columbia River Basin."

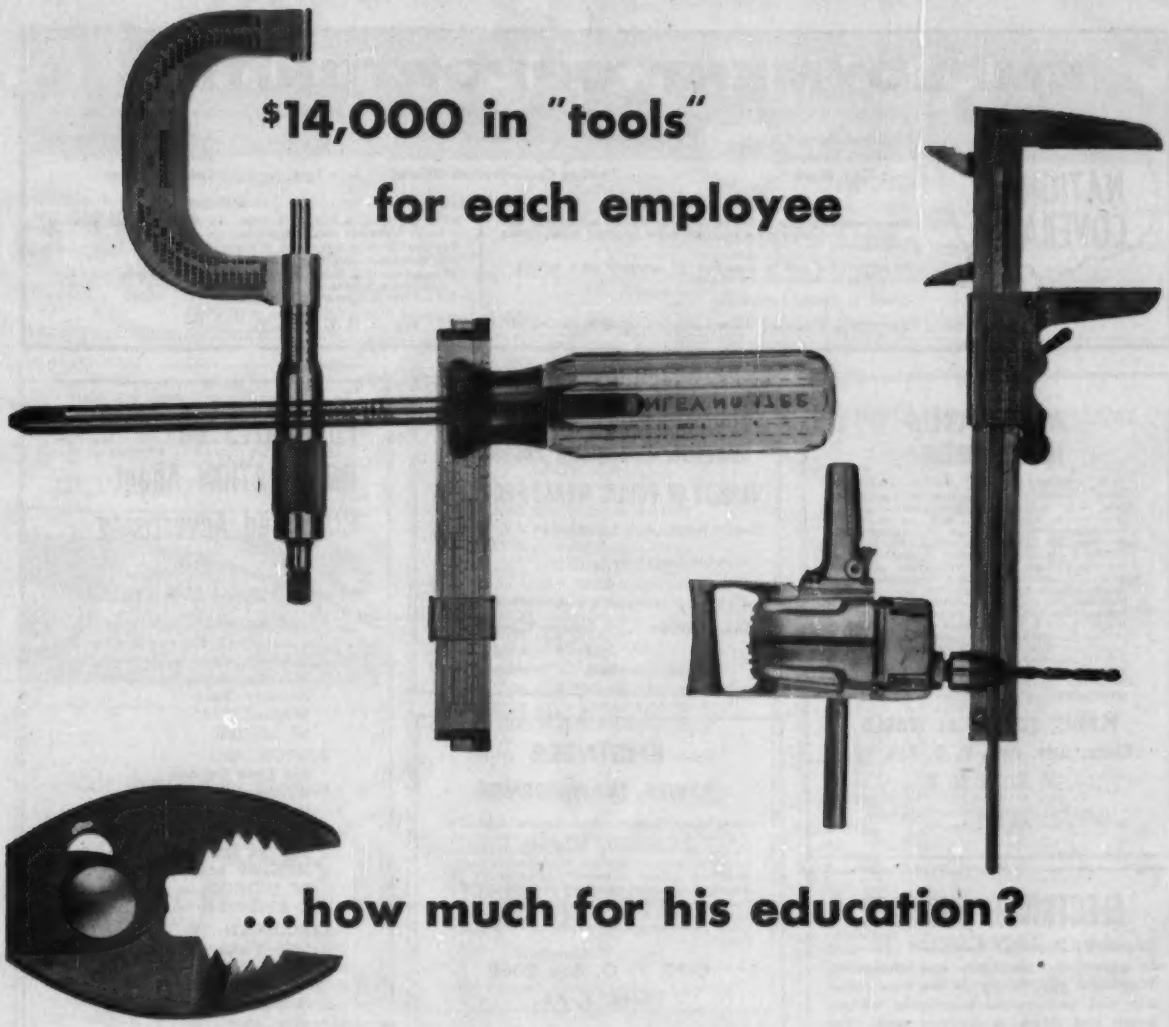
Index Coming Up

Electrical World's semi-annual index for July-December 1956 is now being prepared for inclusion in one of the February issues.

Atom's Power Demands Seen as Industry Threat

New York State Commerce Commissioner Edward T. Dickinson has predicted that atomic energy installations are consuming so much industrial electrical power that the nation may eventually be "faced with the quandary of retarding atomic development or of shortchanging industry."

He said that in spite of atomic energy's promises for the future, the production of atomic fuel and bomb material "holds an implicit threat to our industrial and business establishments. We must find a way to meet this mounting demand for power by our atomic installations and by our industrial establishments."



$14,000 in "tools" for each employee

...how much for his education?

Today, business invests an average of $14,000 in each employee's job. The question for businessmen is: Are we training enough people who can hold down these jobs? Schools are the answer. And it's simple self interest to help community groups get the teachers and equipment schools need. Shortage right now: 200,000 classrooms, 165,000 teachers!

PUBLIC SERVICE ADVERTISING COUNCIL

Want to find out how to help in *your* community?
Get specific information by writing:
Better Schools, 9 East 40th Street, New York, N. Y.

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Service
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Positions Wanted ads are ½ of above.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

APPARATUS ENGINEER

Large electrical manufacturer of switchgear, unit substations, transmission and distribution switching and protective equipment desires services of apparatus engineer for Atlanta, Georgia location. Duties initially will consist of contacting electric utilities in 4 southeastern states with our established field organization, specifically to do product line sales promotional work on high level engineering basis. Man chosen will be graduate electrical engineer, 30-40 years of age, with successful engineering, operation or sales experience with class of equipment listed. Travel required 60%-70% of the time. Home weekends. Substantial opportunity. Refresher training provided initially and periodically. Address replies to:

P-3893, ELECTRICAL WORLD
Class. Adv. Div., P. O. Box 12,
N. Y. 36, N. Y.

Giving complete resume of experience and financial history.

ELECTRICAL ENGINEER

Graduate Electrical Engineer interested in operation, planning, and designing. Wonderful opportunity to use own initiative and gain varied experience without being tied down to drafting table. Top fringe benefits and $6000 yearly starting salary. Located within 30 miles of Minneapolis, Minnesota. For information, write Personnel Department

Rural Cooperative Power Association
ELK RIVER, MINNESOTA

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

P-3234, Electrical World,
330 N. Michigan Ave., Chicago 11, Ill.

WANTED—RELAY TEST ENGINEER

Excellent opportunity in Relay Test Section of Massachusetts utility. Good knowledge of electronics a necessity. E.E. degree helpful. Salary commensurate with experience and education. Write resume of experience, education, personal data, and salary requirements. All held in strict confidence.

P-3700, Electrical World
Classified Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

San Francisco City and County
Immediate Employment Possibilities
VARIETY OF PUBLIC WORKS PROGRAMS

Junior Engineer (Electrical) $460—$530
Assistant Engineer I (Electrical) $500—$600

For Further Information and applications, inquire:

San Francisco Civil Service Commission
154 City Hall
San Francisco, California

ENGINEER
POWER TRANSFORMER

Graduate Engineer from recognized college for development and design of power transformers. Recent experience in all phases of design work important. Position offers unusual opportunity in an advancing endeavor. All communications will be held in confidence. Salary determination based on ability and past performance record. Reply fully to—

C-79, P. O. Box 2068
Phila. 3, Pa.

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITION VACANT

Electrical Designers—Top salary, plus scheduled overtime at time and one half rates. Immediate openings, permanent positions, paid holidays, vacations, recreational activities, including bowling teams, etc. Marbarry Corp. 120 Greenwich St., NY 6, NY. REctor 2-3749.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connections under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

POSITION WANTED

Load Dispatcher on 500MW system desires change. Age 35, PW-3868, Electrical World.

ANYTHING within reason that is wanted in the field served by Electrical World, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

FOR RATES OR INFORMATION About Classified Advertising

Contact
The McGraw-Hill Office
Nearest You

ATLANTA, 3
801 Rhodes
Haverty Bldg.
WAlnut 5778
W. LANIER

BOSTON, 16
350 Park Square
HUbbard 2-7160
H. J. SWEGER

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
W. HIGGINS
J. BRENNAN

CINCINNATI, 37
1825 Yorktown Rd.
Swilton Village, Apt. 2
REdwood 1-3238
G. MILLER

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
W. SULLIVAN

DALLAS, 2
Adolphus Tower
Main & Akard Sts.
Riverside 7-5064
D. BILLIAN

DETROIT, 26
856 Penobscot Bldg.
WOodward 2-1793
W. STONE

LOS ANGELES, 17
1125 W. 6th St.
MAdison 6-9351
E. SHIRMER

NEW YORK, 36
330 West 42 St.
LOngacre 4-3000
R. LAWLESS
D. COSTER
R. HATHAWAY
S. HENRY

PHILADELPHIA, 3
17th & Sansom St.
RIttenhouse 6-0670
E. MINGLE
H. BOZARTH

SAN FRANCISCO, 4
68 Post St.
DOuglas 2-4600
R. C. ALCORN

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

FOR SALE

1875 KW MOTOR GENERATOR SET

1875 KW General Electric generator, 250 volts direct current, direct connected 2500 HP General Electric synchronous motor, 3 phase, 60 cycle, 11,000 volts, 600 RPM, complete with automatic switchgear. Excellent condition.

INTERNATIONAL POWER MACHINERY CO.
Union Commerce Bldg. Cleveland 14, Ohio

BUYERS OF
SURPLUS COPPER
WIRES AND CABLES
PIERCE WIRE & CABLE CO.
2939 N. Paulina Chicago 13, Ill. Eastgate 7-4777
Inspections Made Everywhere
Firm Offers Cheerfully Made

This Searchlight Section

of ELECTRICAL WORLD

is an index of reliable sources for Used and Resale electrical equipment now available. Consult the *Searchlight Section* in following issues for later offerings.

If you don't see what you want—ask for it. Ask the advertisers. Dealers are constantly adding to their stocks and may have acquired just what you need.

And, when you have special items to dispose of, dealers will be glad to know of it, or you can use this Searchlight Section to contact user-buyers direct, if you prefer. Send a list of your equipment and we will gladly give full space and rate information.

Write

Classified Advertising Division

P. O. Box 12

ELECTRICAL WORLD

330 W. 42nd St.
New York 36, N. Y.

TRANSFORMERS

FOR SALE

3—1000 KVA Mol 11500-2400/4160Y
3—1000 KVA Mol 13200-2400/4160Y
3— 500 KVA W-H 33000-2400/4160Y
3— 500 KVA G-E 22000-2300/4000Y
3— 500 KVA G-E 13200-240/4160Y
3— 333 KVA A-Ch 14400/14100/13800/13500/13200-240/480
3— 250 KVA G-E Ditto
3— 167 KVA W-H Ditto
6— 250 KVA W-H 22000-7200/12470Y
3— 200 KVA Mol 7200/12470Y-2400/4160Y
4— 100 KVA A-Ch 33000-7200/12470Y
4— 100 KVA W-H 22000-6900/11950Y

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

Branch Office

Houston—Walnut 3-4530
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL WIRE and CABLE CO.

2929 N. Paulina St. Chicago 13, Ill.
EAstgate 7-4777 Code: UNIWIRE

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?

BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL. 3-3334

BOOKS AND PERIODICALS

A.I.E.E. Transactions wanted to buy for cash and other technical and scientific periodicals. E. W. Ashley, 27 E. 21, N.Y.C. (10).

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFGR.	VOLTAGE
3	667	Kuhl	66,000—480
3	200	Pitts.	66,000—2300
3	1500	Wag.	44,000—6900/11950
3	1250	A.C.	44,000/11500—460
3	75	West.	44,000—7200/12470Y
3	5000	G.E.	38100/66000—6600
4	3333	G.E.	38100/66000Y—33000
6	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	33000/11000—2400/7200
2	3000	Stand.	33000—4160, 3 Ph.
4	1667	West.	34,500—7200, Insetaire
3	1500	A.C.	34,500—2300
3	667	A.C.	33,000—2400/4160Y
3	500	West.	34,400—13,800
4	333	Kuhl	33,000—7200/12470Y
3	200	A.C.	34,500—2400/7200/12470Y
3	75	Wag.	33,000—240/480
1	3000	A.C.	23,380—2500/4330Y, 3 Ph.
3	2000	A.C.	26,400—13,200
3	1000	G.E.	23,310—2500/7500/12990Y
3	100	G.E.	22,000—7200/12470Y
3	50	G.E.	22,000—2300
2	3000	G.E.	13,800—600, 3 Ph. Unit Sub.
3	1667	G.E.	13,800—600
3	1200	West.	13,800—600, 3 Ph. Unit Sub.
3	1000	West.	13,200—2300, 3 Ph. Unit Sub.
1	1000	A.C.	13,800—480, 3 Ph.
1	600	Stand.	13,200—2300, 3 Ph.
1	450	Penna.	13,200—2400, 3 Ph. Askarel
3	200	G.E.	13,200—2400
3	50	West.	13,750—125/250
1	2500	A.C.	11,000—2400/4160Y, 3 Ph.
3	125	A.C.	6900—2300
3	500	West.	2400/4160Y—240/480
3	150	West.	2400—230/115
1	100	G.E.	2300—575, 3 Ph.
6	50	West.	2400—114/238, Dry Type

FEEDER REGULATORS—Outdoor

1	500	West.	167 A. 34500 V. 3 Ph. STEP
1	250	A.C.	601 A. 2400 V. 3 Ph. STEP
3	96	G.E.	200/400 A. 2400 V. 1 Ph. IND.
8	36	West.	150/300 A. 2400 V. 1 Ph. IND.

ALSO: FREQ. CHGRS., M-G SETS, SYN. CONDENSERS, OIL CIR. BRKRS, ETC.

BREW, WOLTMAN & CO., INC.

52 Church St., New York 7, N. Y.

METERS WANTED

THE ELECTRICAL WATTHOUR METER CO.

76-15 Woodside Ave. Elmhurst 73, N. Y.
Phone HAvemeyer 9-0131

PROFESSIONAL SERVICES

AMERICAN AIR SURVEYS, INC.
Engineers

• Transmission Plan & Profile
• Stockpile Inventory
• Topo Maps for Reservoir Studies
• Stereo-photos for Planning

907 Penn Ave. Pittsburgh 22, Pa.

BARKER & WHEELER
Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH
Consulting Engineers

Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway Kansas City 14, Mo.

THEODORE D. BROSS LINE CONSTRUCTION CORP.
Steel Tower & Wood
Transmission Lines
Distribution & Maintenance

175 Enfield St. Hartford, Conn.

BURNS and ROE, Inc.
Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical
Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

COMMONWEALTH SERVICES INC.
Management and Business Consultants
300 Park Ave
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

DAY & ZIMMERMANN, INC.
Engineers

Design - Construction - Management
Reports and Valuations

New York Philadelphia Chicago

DOBLE ENGINEERING COMPANY
Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.
Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION
Construction & Maintenance
Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. Binghamton, N. Y.

FORD, BACON & DAVIS
Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GILBERT ASSOCIATES, INC.
Engineers and Consultants

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH

Reading, Pa. New York, N. Y.

HARZA ENGINEERING CO.
Consulting Engineers

Calvin V. Davis E. Montford Fuelk
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.
Engineers and Consultants

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

JENSEN, BOWEN & FARRELL
Engineers

Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Original Cost and Continuing Property Record Determination

Ann Arbor, Michigan

M. W. KELLOGG
Piping System Design Analyses

Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.

The M. W. Kellogg Company
711 Third Ave., New York 17, N. Y.

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical

1200 N. Broad St., Philadelphia 21, Pa.

PETER F. LOFTUS CORPORATION
Design and Consulting Engineers

Electrical • Mechanical • Structural
Civil • Thermodynamic • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

THE LUMMUS COMPANY
Engineers and Constructors

385 Madison Ave., New York, N. Y.

Chicago . . Houston . . London
Paris . . The Hague . . Montreal
Caracas . . Bombay

CHAS. T. MAIN, INC.
Engineers

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Designs and Construction Supervision

80 Federal St., Boston 10, Mass.

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design
Engineers . . Purchasing
Specialists in Financing
Accounting and other Operations

231 So. La Salle St. Chicago 4

SANDERSON & PORTER CONSTRUCTION
Reports Surveys

New York New York

SARGENT & LUNDY
Engineers

140 South Dearborn St.

Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals

50 Church Street, New York 7, N. Y.

SVERDRUP & PARCEL, INC.
Engineers - Architects

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis San Francisco Washington

TIPPETT & GEE
Consulting Engineers

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process

1333 North Second Street Abilene, Texas

F. A. TUCKER, INC.
Contractors—Engineers
specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 38½ Center Street, Rutland, Vt.
Branch Office — Little Rock Road, Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road Jenkintown, Pa.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

Advertising in This Issue

Advertising Council, Inc..... 121
Allis-Chalmers Mfg. Co....4th Cover
6, 7, 95
Aluminum Co. of America..... 27
Anderson Electric Corp..... 17

Baxter & Co., J. H..... 18
Bell Telephone Laboratories..... 115

Clark Controller Co..... 87
Coles Cranes, Inc..... 94
Colorado Fuel & Iron Corp.,
Wickwire Spencer Steel Div... 101

Directory of Engineers..... 124
Dodge Div., Chrysler Corp..... 28
duPont de Nemours & Co. (Inc.)
Polychemicals Dept. 35

Eastern Specialty Co..... 100
Electrical Engineers Equipment
Co. 16
Electrical World 102, 111
Elliott Co. 11
Engineers, Directory of..... 124
Esterline-Angus Co., Inc..... 92
Everstick Anchor Co..... 78
Exide Industrial Div., The Electric
Storage Battery Co.....3rd Cover

General Electric Co.,
Apparatus Dept. ..64, 65, 67, 68, 69
Electronics Dept. 8
Gulf Oil Corp..... 93

Hazard Insulated Wire Works... 4
Heating & Air Conditioning
Exposition 125
Hubbard & Co.....84, 85

I-T-E Circuit Breaker Co.,
Switchgear Div. 90, 91

Jenkins Bros. 75
Johns-Manville 113

Kaiser Aluminum & Chemical
Sales, Inc. 104, 105
Kerite Co., The..... 38
Kim Hotstart Mfg. Co..... 102
Kuhlman Electric Co..... 34

Lapp Insulator Co., Inc..... 14
Line Material Co....29, 30, 31, 32, 33

McCabe-Powers Auto Body Co... 15
Minerallac Electric Co..... 120
Minneapolis-Honeywell Regulator
Co., Industrial Div.....72, 73

National Telephone Supply Co... 98
Natvar Corp. 71

Ohio Brass Co.....23, 106
Okonite Co., The..... 4

Page Fence Assoc..... 92
Pennsylvania Transformer Co.... 9

Royal Electric Mfg. Co., Inc.... 117

Sangamo Electric Co..... 26
Searchlight Section 122, 123
Shaw-Perkins 120
Simplex Wire & Cable Co..... 89
Standard Transformer Co.....96, 97

Texas Co., The.....2nd Cover
Thomas & Betts Co., The..... 103
Triangle Conduit & Cable Co., Inc 25

United States Rubber Co..... 10
United States Steel Corp..... 119

Wagner Electric Corp.....76, 77
Walker Div., Norma-Hoffmann
Bearings Corp. 118
Westinghouse Electric Corp....12, 13
24, 36, 37, 79, 80, 81, 82
Wickwire Spencer Steel Div.,
Colorado Fuel & Iron Corp.... 101
Willys Motors, Inc..... 126

■

PROFESSIONAL SERVICES 124

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 122

EQUIPMENT
(Used or Surplus New)
For Sale 123

NEW EQUIPMENT *and* NEW METHODS

13th INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

(formerly the International Heating & Ventilating Exposition)

INTERNATIONAL AMPHITHEATRE
CHICAGO

FEB. 25 to MARCH 1, 1957

Under the auspices of the American Society of Heating and Air-Conditioning Engineers, and in conjunction with their 63rd annual meeting.

IN the largest exposition of its type in the world, there will be new equipment, new methods, new technical information. More than 450 companies will welcome you, your key men and associates in Chicago next February. Make it your *first* New Year's Resolution to write for advance registrations to:

13th INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

480 Lexington Ave., New York 17, N. Y.

Management: International Exposition Co.

New capacity!

The completely new Forward Control 'Jeep' FC-150—the first time a 4-wheel-drive Truck has so effectively combined maximum cargo capacity with exceptional maneuverability! New Forward Control design puts a 74" pickup box on an 81" wheelbase. And the FC-150 retains famous 'Jeep' ruggedness and versatility.

New maneuverability!

It's the world's shortest turning 4-wheel-drive Truck! For safer off-road maneuverability, it gives you up to 200% greater forward visibility. Powered by the engine that made 'Jeep' vehicles famous, the new FC-150 provides the extra traction of 4-wheel drive for off-road travel, shifts into 2-wheel drive for highway travel.

New style!

The new look and feel of tomorrow! The FC-150's Safety-View Cab combines beauty with utility. Its new wrap-around windshield is the largest in the 5,000 GVW class. There's plenty of extra leg and head room. Here is new styling, comfort, convenience and safety all in today's most advanced 4-wheel-drive Truck.

New 'Jeep' Forward Control 4-Wheel-Drive FC-150

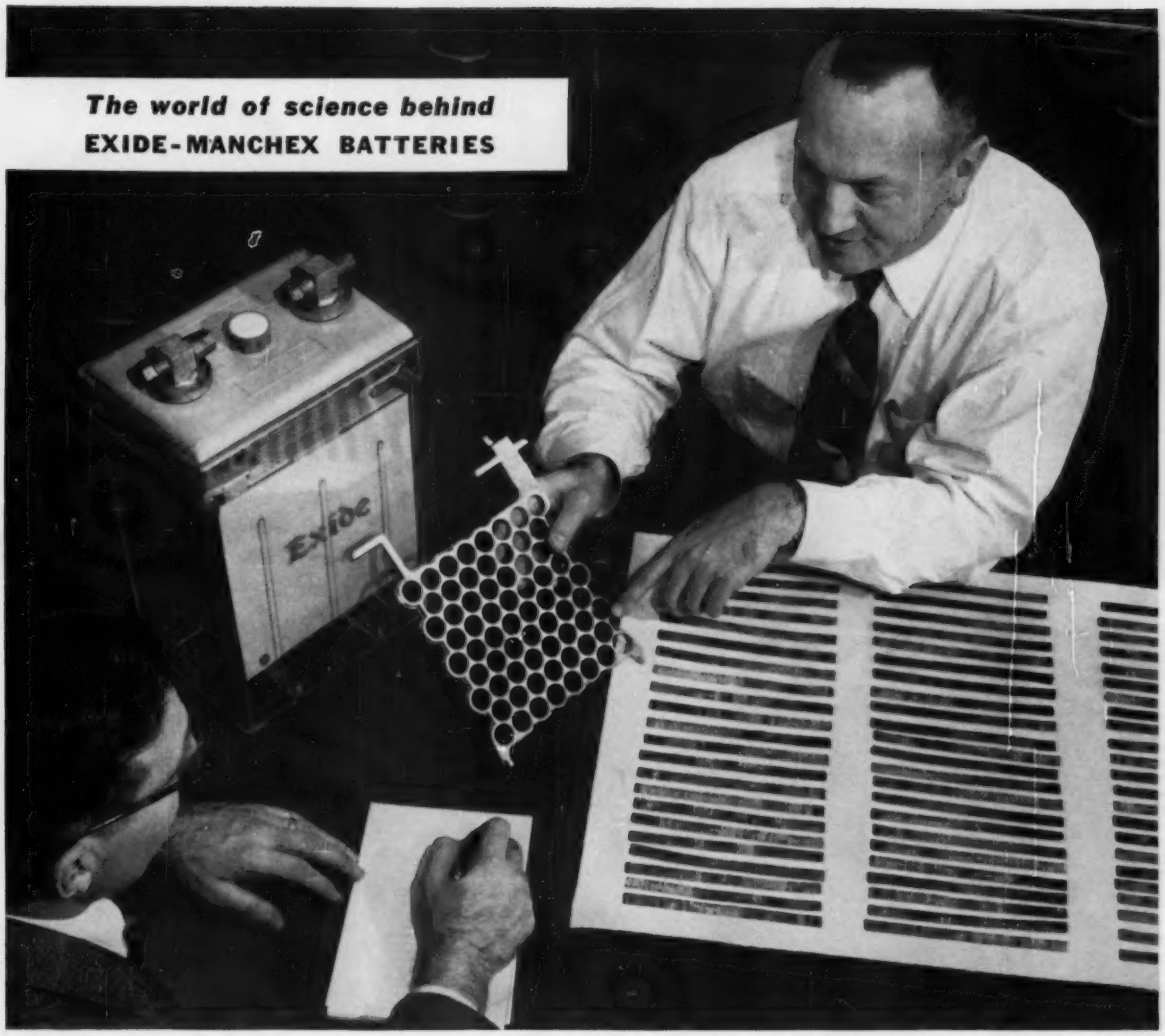
Willys...world's largest makers of 4-Wheel-Drive vehicles

...other members of the famous 'Jeep' family:

Universal 'Jeep' | 'Jeep' Truck | 'Jeep' Utility Wagon

See 'Jeep' vehicles at your WILLYS dealer

The world of science behind
EXIDE-MANCHEX BATTERIES



Being interviewed is Dr. H. J. Strauss, Chief Product Engineer

"Plates last longer because they're 5 times bigger"

At the Exide Laboratories— **Reporter:** Just what are all those lead strips?

Strauss: Here we've taken the spiral lead buttons from a single Exide-Manchex positive plate and unrolled them on this table. This total area is actually five times the plate size.

Reporter: I see the strips are corrugated on one side. Is that to increase the surface area?

Strauss: Yes, and also to give the electrolyte free access into the interior of the spiral buttons.

Reporter: How does this feature affect battery performance?

Strauss: It means each part of the surface of the positive plate works easier to produce electricity. An Exide-Manchex can coast where many another battery is forced to strain. And the active material lasts years longer than it otherwise would.

Reporter: Is this construction available in any other battery?

Strauss: No, only in the Exide-Manchex.

Reporter: Obviously this is an important feature of the Exide-Manchex Batteries.

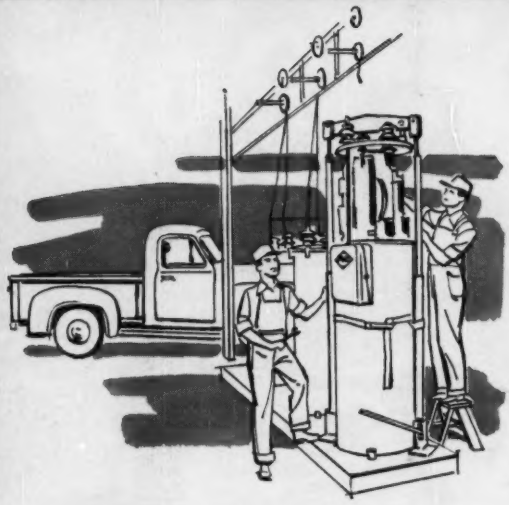
Strauss: Yes it is, but it's only one of many engineering details that contribute to their long life.

Note to battery users: Whenever you order batteries for floating service applications or the equipment that requires such batteries, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY Exide®

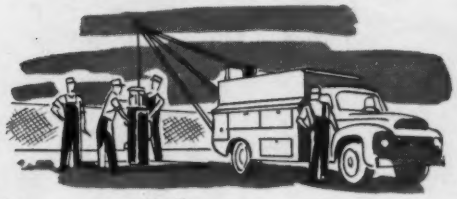
Compare Allis-Chalmers Regulators with Others

Slash Regulator Service Costs 75%



THIS

On-the-spot service with Allis-Chalmers cover-suspended regulators—2-man crew and pickup truck does the job without moving unit.



OR THIS

Other regulators usually require a 4 or 5-man crew and boom truck to move regulator and do piecemeal untanking and retanking.

1—Drain oil from tank

2—Remove cover, bushings and control leads

3—Piecemeal untanking

Eliminates need for moving and piecemeal untanking which costs 4 to 5 times more!

This is the key to savings with Allis-Chalmers regulators! Unit construction makes it possible. A 2-man crew using a pickup truck (not a boom truck) can switch the regulator off the line, set up the portable hydraulic jack and in a few minutes lift the entire regulator mechanism far enough out of the tank for inspection. Only Allis-Chalmers regulators provide full unit construction.

For complete information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

LIVE BETTER ELECTRICALLY

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-3139